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BOWLING ALLEY LIGHTING.

By ROBERT FF. PIERCE.

The problems presented in bowling alley lighting are in many respects rather perplexing. In the first place, there is a great diversity of opinion as to what constitutes good or even acceptable lighting. A system quite satisfactory to one skilled player will be condemned by another equally competent, as far as ability to play the game is concerned. This is largely due to the fact that up to the last two or three years, nearly all bowling alley lighting was very poorly done, and those players who bowled successfully upon the poorly lighted alleys are slow to believe that any radical different system does not represent a step in the wrong direction. They look for certain things that they have been accumstoned to seeing, and failing to find them, imagine that their absence indicates faulty illumination.

The system of bowling alley lighting in vogue a decade or so ago is well represented in Fig. 1. Lamps were concealed under a crudely constructed hood, which was supposed to "throw the light downward," and illuminate the alley effectively. What happened to the light after it reached the alley nobody appeared greatly to care. The result was that the light, reflected to the eye from the polished surface of the alley as from a mirror, made a rough sort of image of the light source upon the alley, and the splotches of intense glare that resulted were taken as evidence that the alley was well illuminated. As a matter of fact, this "glare" is the very worse feature that could be introduced, with the sole exception of bare, unconcealed lamps.

To eliminate the glare, shades were designed of such form that no light could be directed at angles permitting direct reflection to the eye. (Fig. 2.) This naturally produced an appearance of comparative darkness, as most of the light was reflected as shown by the arrows, only a small portion reaching the eye. Experience soon proved, however, that the demand for an apparent brightness of the alley was only the result of imagination. All that is required is that the bowler be able clearly to distinguish the edges of the alley; the really important point is the pinboard. It is much like wing-shooting. The most successful marksmen keep their eyes on the bird, paying little attention to the rib of the gun, but trusting to the co-ordination of trained nerves and muscles to secure proper aim. Just so, the most skillful bowlers keep their eyes on the pins, "setting the ball to the alley" and allowing for curvatures or irregularities instinctively.

The system of lighting shown in Fig. 3 was designed to cause the pins to "stand out" in strong contrast, thus focusing the bowler's attention upon them. Many bowlers even prefer to magnify this effect by placing the lamps over the runway in such a way as

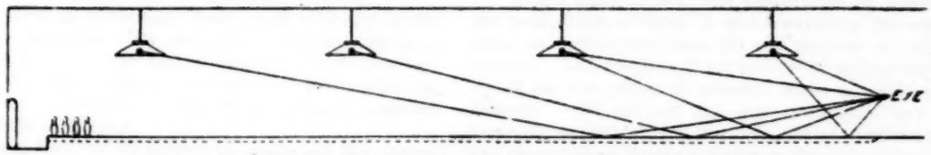

Fig. 1.—Lamps under Hoods, and Light reflected to the Eye of the Bowler.

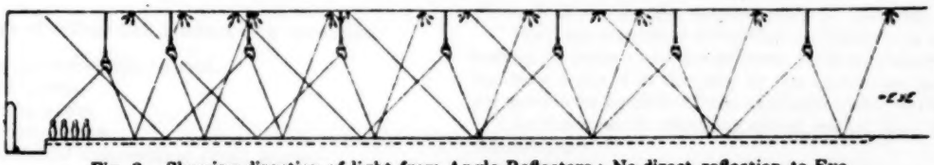

Fig. 2.—Showing direction of light from Angle Reflectors: No direct reflection to Eye.

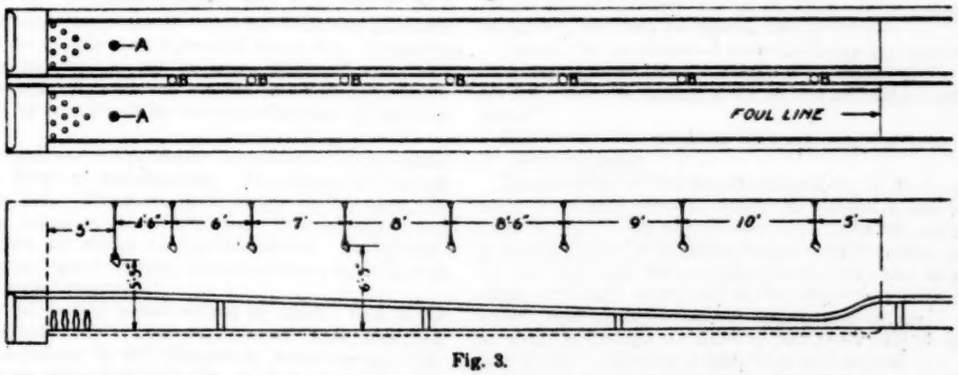

Fig. 3.

Equip all outlets with No. 6 Reflex Lamps with No. 318 clear cylinders and No. 445 or No. 534 Reflectors.
If Remote Control be desired, use individual No. 120 Magnet Valves and Reflex Spark Lighting System.
Use No. 44 Reflex Ceiling Shields where distance from vent of lamp to ceiling is less than 18 inches, otherwise No. P-8717 Pendant.

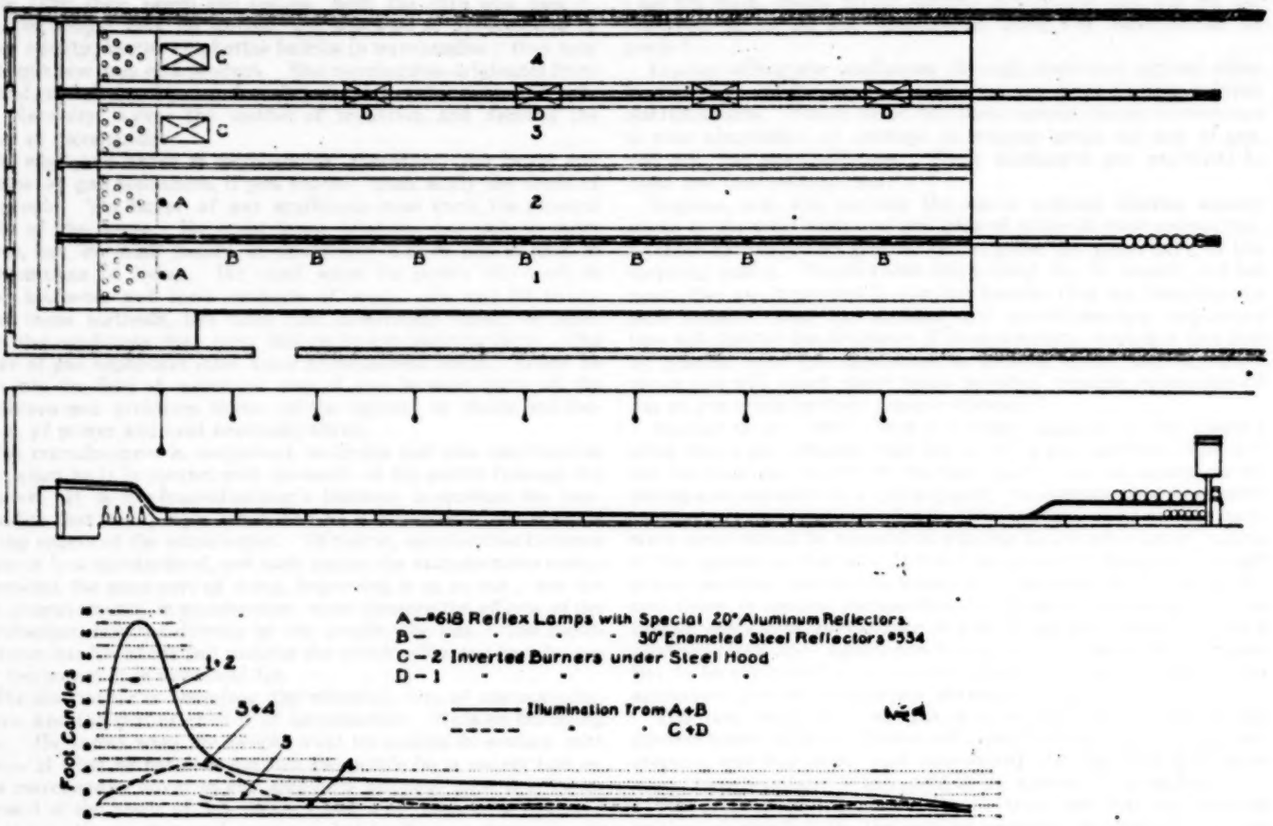

Fig. 4.—Illumination of four Alleys, lighted by systems illustrated in Figs. 1 and 2.

to cause a comparatively dark spot immediately in front of the pinboard. This is done by making a larger space between the pinboard and the first lamp over the runway. This system is perhaps the simplest for producing a uniform illumination upon the alley. The illumination is amply sufficient to enable the bowler to see the floor of the alley plainly and to follow the travel of the ball, the latter standing out in strong contrast to the floor.

The relative illumination obtained by the system represented in Figs. 1 and 2 are shown in Fig. 4, the dotted lines representing that from the former, the full lines from the latter. The numbers indicate the alleys upon which the illumination was measured. Thus the full line curve marked 4 represents the illumination on alley No. 4 from the lamps above the runway between alleys 1 and 2. In practise, of course, all alleys would be equipped alike, and the illumination on alley No. 4 would be that on No. 1, *plus* that shown for No. 4 by the curve.

To secure uniform illumination on the floor of the alley small units are necessary, as the distribution required for this purpose cannot be readily obtained from large units, on account of the difficulty of properly redirecting the light rays from large sources—a difficulty that will be immediately appreciated by one having experience in reflector design.

Under certain favorable conditions, however, fairly satisfactory results may be obtained from large units; and they offer considerable advantages in the way of first cost and maintenance expense. Fig. 5 shows the distribution from a reflector designed for use in

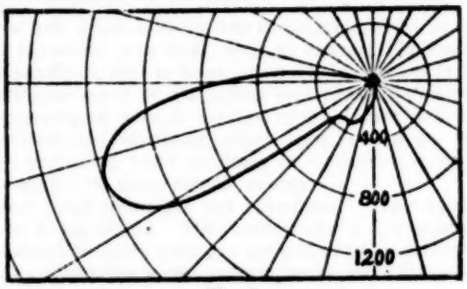

Fig. 5.

connection with a large single mantle unit consuming about 10 cubic feet of gas per hour. When placed 10 or 12 feet above the floor, and a little in front of the middle of the foul line (Fig. 6-A)

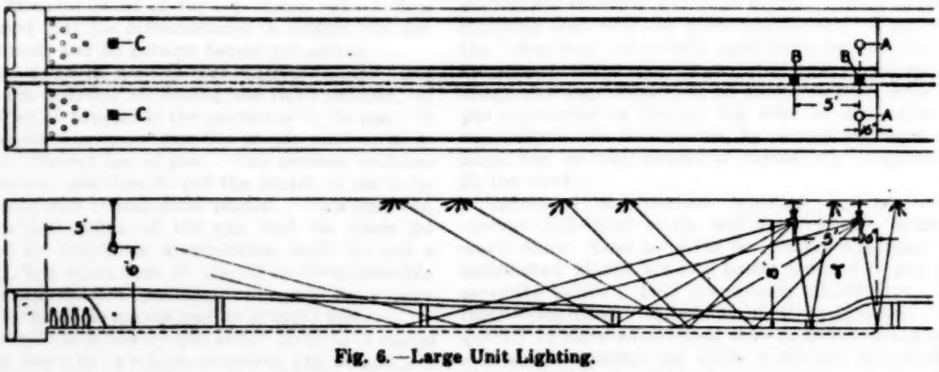

Fig. 6.—Large Unit Lighting.

The figures in the plan illustrate the positions for mantles 8 feet above floor.
Outlets C.—No. 6 Reflex Lamp with No. 534 or No. 445 Angle Reflectors.
Outlets A and B.—No. 20 Reflex Lamp, No. 242 Aluminum Angle Reflector.

a fairly uniform illumination, without glare, will be secured on the alley. If the outlets are placed 2′ in front of the foul line for each foot in height above the floor, a sharp shadow will be cast at the foul line, which materially assists the bowler in avoiding sliding over the line.

If the ceiling is white, the light reflected from it will help the uniformity of illumination (in the manner shown in Fig. 6) to such an extent that the lamps may be placed with the mantles as low as 6 feet above the floor. In case the mantles cannot be placed at least 7 feet high, the lamps must be placed as shown by outlets BB in Fig. 6, *the rear lamp being 2 inches in front of the foul line for each foot in height above the floor.*

An installation of this type of lamp and reflector should not be attempted under dark ceilings unless the mantles may be located at least 10 feet above the floor; and in all cases light ceilings are preferable with this system.

On account of the large quantity of light reflected from the floor to the ceiling, the latter will, if light in color, be brightly illuminated, leading to the mistaken notion that the light is directed upwards from the lamp themselves. That this is not the case is shown by the distribution curve (Fig. 4), and may be demonstrated by viewing the alley from the pinboard end, from which point it will be a sheet of glare.

With powerful reflectors of this kind it is advisable to equip the pin-boys with eye shades.

The following diagram indicates the conditions under which the various systems may be used:

	Mantle Height Available.	*Plan Available.
Rooms with light ceilings..	Less than 8′	Fig. 6, outlets *BB* or Fig. 3.
	8′ to 12′	Fig. 6, outlets *AA* or Fig. 3.
Rooms with dark ceilings..	10′ to 12′	Fig. 6, outlets *AA* or Fig. 3.
	Less than 10′	Fig. 3.

*The plan shown in Fig. 3 is always preferable to that in Fig. 6. Only where the expense of the former is absolutely prohibitive should the latter be considered.

The No. 20 Reflex lamp with No. 242 Reflector should always be placed as high as possible, up to 12 feet above the floor.

SOME PRINCIPLES OF MERCHANDISING APPLIED TO THE GAS APPLIANCE INDUSTRY.

Paper by JOSEPH H. APPEL, Director of Publicity of the John Wanamaker Stores, to the N. C. G. A., at Washington.

This subject will be discussed from two viewpoints: that of the consumer—SERVICE; that of the distributor—EFFICIENCY. The problems of the manufacturer, both of gas and gas appliances, will not be considered except as they enter into that of distribution.

Efficiency is the best, shortest and quickest way to do the thing that is to be done. Service presumes efficient service. Efficient service is impossible without efficiency in the organization that renders service. Merchandising, in the sense in which I use the word, includes a study of merchandise itself—its inspiration, origin, nature and function; the gathering of it into stores and its distributing by them. Merchandising includes wholesale buying and retail selling, and an intimate relationship with production, as well.

In addressing men of experience and ideals, such as make up this gathering, it may be assumed that we agree that a business is profitable to the owner only to the degree that it renders good service to the public. The day of sharp practices and double dealing, of squeezing the public in business of any kind is happily passing. To-day it is "the public be served."

Assuming, therefore, that we all believe in rendering the utmost service, the problem then is: how to render the best service to the public.

There are five ways of selling any product to a consumer:

1. By the manufacturer, direct.
2. By mail order.
3. By chain stores.
4. By agency stores.
5. By individual independent retail stores.

Since efficiency is the shortest, quickest and best way to do a thing, efficient merchandising is the shortest cut from the producer to the consumer. If no middle man is needed there is no excuse for having one. Unless mercandise can be more efficiently and more economically distributed by means of a middleman, it were better that all merchandise be sold direct by the manufacturer to the consumer.

This direct short cut from the producer to consumer is absolutely impossible for most kinds of merchandise. The shoemaker is best when he sticks to his last. The manufacturer can do his most efficient work when he sticks to manufacturing. The merchant can be most efficient when he sticks to merchandising. To attempt both manufacturing and merchadising is nearly always fatal to both ends of the double-headed business.

Mail order selling is merely retail selling by mail. It is in the same category as the individual independent retail store, and need not be considered, therefore, in this discussion. Since the gas business is controlled by an individual company in each city and town, the chain store method of distribution does not apply.

There remain, therefore, to be considered two methods of distribution:

Agency stores.
Individual independent retail stores.

To be exact in my classification I asked a member of the N. C. G. A. to indicate the methods now used by gas companies in selling or renting appliances. His reply introduced another point, that of selling at a loss, which is particularly pertinent to this discussion.

"In some cases," says the expert, "the Appliance Selling Department is a separate organization from the gas company, with show rooms and offices of its own. The majority of gas companies, however, handle it as a part of the commercial end of the undertaking. In either case the Appliance Department is charged with the expense and credited with the income, and it is the purpose of almost all gas companies to make this account show a profit.

"In the early days of the application of gas to other uses than the production of light, it was frequently the custom to sell appliances at cost or even less, for the purpose of securing their introduction; but I believe I am correct in saying that the great majority of gas companies at present make a profit on the sale of appliances. Of course, the gas companies are in the appliance business, primarily, for the purpose of increasing the sale of gas, and they cannot hope to continue this sale through the instrumentality of appliances that are not suited to the purpose, either through faulty design, workmanship or material.

"They are therefore compelled to exercise a certain amount of control in order to secure efficient service to their consumers. This has been secured in the past by the companies handling as great a proportion as possible of the appliances sold in their territories.

"In this sense it might be called one of the 'Special services of the company.'"

Distributing appliances through any agency owned or controlled by the gas companies makes of these distributing organizations, whatever they may be called, agency stores.

One of the problems of merchandising gas appliances, therefore, narrows down to this: "Which will render to the public the best service—the gas agency store or the individual independent retail store?"

To consider this problem we must consider some of the principles of merchandising.

The problem of all merchandising is to have what the people want when they want it, where they want it, and at the price they want to pay. The storekeeper who aims to remain permanently in business, who is building business rather than merely getting it for the day, must be sure that his merchandise, in addition to being what the people want, and at the price they want to pay, is trustworthy and will give lasting satisfaction in use. Permanent and growing businesses are built on the good will of the public, which comes from continued satisfaction and service.

Merchandising is divided into two parts: merchandise and service. Merchandise is inanimate. Service is animate, personal. Service deals with the human factor.

To procure the kind of merchandise the people want, the storekeeper must know what the people want. Merchandise originates not with the manufacturer, not with the designer; but with the

people, from their needs and desires, with the man who uses it. True, the people may be guided and educated to appreciation of higher quality, better art, better fashion in merchandise; they may be taught new uses of a product. But merchandise originates from demand, and demand comes from the buying and consuming public. Necessity is ever the mother of invention, and demand the father of merchandise.

The wholesale buyer of merchandise, therefore—the buyer and selector of gas appliances, if you choose—must study the needs of the people. The buyer of gas appliances must know the physical needs of the home. He must know kitchens, not only in large homes, but in small homes, in apartment houses and in flats, in all conditions of living. He must know the people who work in these kitchens, and their methods of work. He may try to improve these methods, but must first understand them; he must meet the conditions that exist before he can improve them. The buyer of gas appliances must know all household needs. When he goes into the field of industrial uses of gas, he must know all the conditions and problems there—of the lighting of stores and factories, of power and heat needs anywhere.

The manufacturer is competent to design and plan merchandise only when he is in contact with the needs of the public through the retailer. It is the manufacturer's business to produce the merchandise that the people want, and he is informed of their wants by the orders of the store buyer. Of course, merchandise becomes more or less standardized, and each season the manufacturer makes somewhat the same sort of thing, improving it as he can; but the big improvements in merchandise come through the efforts of the storekeeper, inspired directly by the people who buy. The manufacterer has his hands full making the merchandise the best he can for the money it is to be sold for.

The distributor is therefore the educator, first of the manufacturer, and the real originator of merchandise. He is on the firing line. He knows what the people want by coming in contact with them. If what he has does not suit the people he is plainly told so. The merchandise buyer in gas appliance business must first be informed of the needs of his public; and only then is he equipped to go into the market and procure what his busines demands. It is the buyer's business to get the best merchandise he can at the price he can pay. This figure is fixed by the price the people will pay for a certain article less the store's expenses and profits. To buy as cheap as possible is not good business. To buy as well as possible—to crowd into an article as much value as possible at the price—is good business.

More and more is merchandise being sold and bought on a basis of value received. In the old days it was the custom in New York, especially for large wholesale houses and manufacturers' agents, to set aside a large sum of money for the entertainment of out-of-town and visiting buyers. Salesmen in these fields were selected largely for their entertaining ability. The man who could show the visiting buyers the sights of the town, who could select and eat heavy dinners every evening, take the visitors to the theatre and spend the rest of the night in carousing, was the man who sold the most goods. To-day merchandise is sold on merit, not by favor. Stores no longer send convivial buyers to New York; they send men who know merchandise and who buy wisely. Wholesalers and manufacturers no longer have good sports as their representatives. They select men who know the product, the needs and demands of the public, and the psychology of salesmanship. Bribery also used to be a great factor in buying and selling, but to-day it is almost unknown.

Merchandise is usually bought with trade, time or cash discounts, but if the buyer gets into the habit of buying terms rather than merchandise, he will find that the manufacturer is adding his discounts to the original cost, and he gets no better net prices.

Your problems come down to a somewhat narrow confine, and involve very largely the question of finding the right product, of standardizing it and then of educating the consumer in its use. It seems to be a simple matter to know what the people want or what they ought to have for efficient use of gas. The serious problem is to get the right product, and then to get the people to use it intelligently in their homes and in industrial plants. This involves, as I have indicated, a knowledge of the gas field (to learn the needs), a knowledge of gas appliance merchandise itself (to get a standardized product), but more than all else it involves scientific personal salesmanship and efficient publicity. It calls for a campaign of education—by word of mouth and by printed talk.

Word of mouth advertising is always the best. Next to it comes newspaper advertising, because it comes closest to the people and is speaking through print. Now, how can you get the best advertising of your product, keeping in mind always that advertising, as I use the word, means giving helpful information that will aid the consumer in buying and intelligently using the merchandise he needs?

You are selling gas appliances through your own agency store in your city. If the city is a large one, you have perhaps a dozen district agents. People come into these agency stores in response to your advertising, or perhaps to consult about the use of gas, and they see the appliances. These appliances are explained to them and they perhaps buy.

Suppose, now, you increase the one or a dozen district agency stores to the total hardware and general stores in your community. To these hardware and general stores come the great bulk of the shopping public. People come there every day in crowds, not because they are interested in gas, but because they are interested in their homes. They are seeking new inventions, new appliances that will lighten the drudgery of housekeeping. Isn't it a fact that by placing your gas appliances in general stores and hardware stores you will reach many times as many possible consumers of gas as you reach by your present methods?

Another point. Isn't there a lurking suspicion in the public's mind that a gas company may try to sell a gas appliance that will use the most gas instead of the least gas? Can an agency store, owned and operated by a gas company, be entirely free from self-interest; or the suspicion of it? The general store or the hardware store cannot be accused of wanting to sell more gas by means of the appliances they sell. It could be accused of charging too high prices perhaps, but prices to-day are regulated by competition; and there is general competition in general storekeeping, even though there is no competition in gas, except the competition with electricity and oil. Again, which is more convenient for the public; to be compelled to go to one place, or to find necessary gas appliances in every community wherever the family may live?

You may reply that all this is true, but that hardware and general stores have not shown sufficient interest in selling gas appliances, and that sales, and incidentally the gas that goes with them, have been largely increased by the agency store method.

This is no doubt true, but is it not true also that the general method of distribution, the normal economic method through established stores instead of through agency stores, has not been given a fair trial?

Many gas companies, through their agency stores, have sold gas appliances without profit, expecting to make up the loss by the increased use of gas. At least one company I know of leages certain gas appliances at a nominal figure, losing money on most of the transactions.

Appliances are often sold by gas companies on the installment plan—small payments, long time, without interest. This is another evil of merchandising that is being eradicated by the better stores—to the ultimate good of the public and the stores themselves. The system necessarily adds to the cost of a product, and is not in line with efficient merchandising, which aims to open the shortest, quickest and best road from producer to consumer, cutting away all needless waste—in time, money, energy.

Independent retail stores are not subsidized. They have no gas back of them to pay losses. They must make a fair working profit. They cannot compete with gas companies when prices are cut down to cost. But offer to the general stores and hardware stores a free field, a fair working profit, and they will show wonderful results in the marketing of household gas appliances.

You may say that these stores will "stock" inefficient appliances because they want to bring down the prices. As I pointed out earlier, stores exist solely on the good-will of the public—on trustworthy merchandise and good service. They cannot live by selling anything that will not give satisfaction. They may be fooled in the "stocking" of certain appliances, because they had insufficient knowledge of the uses of gas; but with the co-operation of the gas companies they would not be fooled twice. And it is possible for gas companies to control the kind of appliances stores will sell, especially in the larger sizes, by connecting these appliances in the home free of cost, instead of permitting irresponsible plumbers to do the work.

Additional co-operation between the gas company and the various individual stores will come in the educational publicity work which must be done no matter who does it. Here again established stores are in a better position to get the attention and serve the public. They are already advertising. The public reads their advertising. It believes their advertising. It responds more quickly to store advertising than to gas company advertising. Suppose gas companies set aside a certain appropriation for educational work to be spent in advertising by the stores who market standardized gas appliances. This could be an appropriation on

the basis of business done on gas appliances, or it could be a certain sum allowed on each appliance connected up by the gas company. The individual stores would add to the appropriation, perhaps double it, and in this way additional advertising would be procured.

A house-furnishings buyer in a large general store, in whose department gas appliances are sold, sums up his point of view thus:

"It seems to me that a gas manufacturing company is really a Public Service Corporation, and as such should confine itself, first, to the manufacture of gas, and, secondly, to the supervision of gas-burning devices. Its supervision should consist of the testing out of every device submitted, and controlling their use or nonuse, by refusing to connect up any device of which they did not approve.

"If this condition could be brought about the merchandising of gas-burning devices would be a simple matter for stores—dealers would, of course, refuse to handle any appliance that did not carry with it the approval of the gas companies. Manufacturers of gas devices could not offer for sale anything that did not measure up to the standards of the gas companies, who would, in turn, refuse to endorse anything that would not give perfect satisfaction, from a service as well as an economical basis.

"An arrangement along these lines would be a very inexpensive thing for the gas companies. They must necessarily employ engineers who are competent to test out devices of this character, and they must also employ a staff of mechanics for the making of connections; and, consequently, could carry on this work, practically without any additional cost, while on the other hand it would be impossible for the dealers to do it.

"This arrangement would relieve the gas companies from carrying stock; which, as we understand it, totals thousands of dollars, the loss on stock and leases; and it would make possible the dispensing with the services of many trucks now used for conveying ranges, etc., from place to place, and the men necessary to do this work.

"There is no reason why independent general stores could not handle this class of merchandise, and sell it with the same satisfaction to the customer and profit to themselves, as other lines."

It is not my intention, in this paper, even to try to solve the problem of the best method of distributing gas appliances—whether through the agency store of the gas company or through separately owned, independent retail stores. I am not even expressing an opinion, personal or on behalf of independent retail stores. All that I can hope to do is to point out certain merchandising principles that apply to this problem, and by the aid of which each gas organization must decide the question for itself. Some of these principles have been outlined. Summarized they may be expressed in the form of these texts:

1. Does the marketing of gas appliances by gas companies add to the cost of gas itself?
2. Which method of distribution renders the best service to the public?
3. Which method will distribute useful gas appliances into homes most efficiently, economically and satisfactorily?
4. Which method will best educate the people to the convenience, economy, efficiency and new practical uses of gas—at home and in industrial plants?
5. Which method gives the most efficient distribution from the producer's standpoint—which adds the smallest percentage of expense to the first cost of the product?
6. Which distributor can be relied upon to "stock," advertise and sell the right kind of gas appliances most advantageously to the public—independent retail stores, or agency stores—the service departments of gas companies?
7. Which of the two distributors can give the public the most helpful education in the use of gas, and thus effect the widest most efficient and most serviceable use of this great commodity of good—in light, heat and power?

You see the question narrows down to the two words with which I began this discussion: service and efficiency; and here I leave the discussion of this part of your merchandising problem. * *

There remains to be considered this point: the character of the educational publicity that will bring about a better public understanding of the uses of gas. Publicity applies equally to the gas agency store and to the independent retail store. The only factor here to be considered is the public—service to the public.

Going to the root of the matter, I asked a prominent gas expert—an engineer of utilization in perhaps the largest gas organization in the world—this question:

"Is there not a great tendency to omit gas pipes from modern buildings, electric wiring taking their place? What are the gas companies doing to combat this competition and elimination? What arguments have you that every building erected, even in this age of electricity, should be piped for gas?"

He came back at me in a six page letter. Let me read a summary of his statement:

"There is no longer the same tendency to omit gas piping from modern buildings. This is due to the fact that gas companies have discovered that such a tendency was the result of their failure to aggressively urge, upon architects and builders, the importance of providing piping systems; much has been done to correct this condition.

"We believe that gas is unsurpassed as a convenient source of energy that can be applied to lighting, fuel and power fields with an efficiency second to no other source; and with a distinctive preeminence in reliability, convenience, control, safety, operating efficiency, operating cost and space economy. We undertake to impress this belief upon those engaged in building construction. In New York City we maintain, as a branch of our Department of Utilization, what we call our "Architectural Service Bureau." Through the reports of building operation, representatives of this bureau are in touch with all new buildings projected. They call upon the architects and builders, and urge the installation of complete gas piping systems. The arguments advanced are necessarily many and varied. Let it be understood that we yield nothing to electricity; and we feel that the development and perfection of methods for the utilization of gas are becoming such as to make the general piping of buildings more of an economic necessity than ever before.

"A gas-piping installation in a modern building, if put in at the time of erection, amounts to a very small figure, varying from 0.128% to 0.666% of the total cost of the structure, for buildings varying from a loft building with a comparative small number of outlets, to the more elaborate piping system of a modern office building.

"Naturally the expense of piping a building after its erection is much greater than if installed during erection. There have been many cases of buildings planned and erected without gas-piping systems, in which, after occupancy, gas service has been demanded by tenants, and the owner has been put to the expense of remedying this defect. This has been true, too, of buildings having their own plants for furnishing electricity.

"Continually increasing applications of gas, and improvements in the appliances and methods for its utilization, go hand in hand with the progress in commercial and industrial efficiency. The immense buildings which house our industrial enterprises should, in their equipment, be as modern as possible. Modern business principles call for the most permanent of structures—so permanent that they may be expected to outlast the present generation by many years. The character of the occupancy and the uses to which the premises are put may change many times from those for which they were originally intended. We have seen not only single buildings completely change their character of occupancy, but whole neighborhoods change. Demands are created which were not anticipated. We have many and increasing industries and professions housed in business edifices. Doctors and dentists are becoming tenants of buildings originally erected for business offices; chemists and jewelers occupy buildings erected for office or loft purposes; laboratories of all kinds are entering this class of buildings and many instances are recorded of clubs and large restaurants locating on the upper floors of office buildings. In these, as in many other industries and professions, gas has its specialized applications. Due to this variable condition of tenancy, no building can be considered modern, complete or capable of answering all demands that can be made upon it, unless it is so constructed as to make possible the use of all efficient sources of energy in the lighting, fuel and power fields.

"The more complete the service that can be offered, the more valuable as a rental proposition the building will be. We have known of instances where prospective tenants refused to occupy space offered because gas service was not available, and where the owner had to provide it at much greater expense than would have been the case if the piping had been installed originally.

"To all of this may be added a closing argument; that the modern age witnesses the continual effort toward improvement of existing energy sources and their applications. The use of gas is constantly being extended to new applications, and this development may be logically expected to continue indefinitely.

"Development in the application of gas to space heating by

direct radiation promises much, as well as the application of direct radiant heat to many other purposes.

"Gas in the lighting field has many advantages, in appearance, flexibility, ease of control; and it has pre-eminent advantages in reliability, safety, cost, quality of light aud hygienic effect. As a fuel, it has these advantages as well as conveniences, cleanliness, ease and exactness of control, speed, space, labor and operating economy."

Assuming, therefore, that whatever the tendency has been to omit gas pipes from modern buildings, this fault has been corrected, I shall conclude this paper, already too long, by a short statement of a few publicity principles which seem to apply to the marketing of gas appliances, whatever method of distribution is selected.

My first principle is this: Advertising is not to sell goods; it is to enable the public intelligently to buy goods that will render to them the best service. In other words; advertising to be efficient must take the customer's viewpoint.

Second principle: advertising is news. News is not advertising, but advertising, to be real advertising, must be news. Find news in the merchandise; find the human interest story; and tell it. Tell the story in a newsy, human interest way, tersely, plainly, convincingly.

Third principle: tell the story fairly—in fairness to the merchandise and to the intended user. Do not exaggerate. Do not mislead. Do not conceal. Tell the whole truth—whatever the public has a right to know; whatever will help it in buying and using. Remember that a sale is never complete until the customer secures lasting satisfaction with the merchandise; that a deal is unmoral, or immoral as you choose to call it, that does not mutually benefit both parties to the transaction—the buyer and the seller.

These principles include economics, psychology, logic and ethics—without which no advertising can be successful.

Advertising is justified only as an aid in the distribution of merchandise. Unless it distributes merchandise more efficiently and more economically than the same merchandise could be distributed without advertising, it is an expense and not an asset to business.

All advertising should be educational. It should educate not only in the construction and materials of a product, but also in its use. In gas appliances use is the main thing; how they can be most useful.

Here your field is unlimited. I have seen the book, probably well known to all in this audience—"A Thousand Uses for Gas" What a marvelous vista that title opens up! A thousand uses for gas. And the Public is familiar—as a mass—with perhaps a dozen uses. Ask any householder you meet how many uses gas can be put to; the reply will be "gas cook stove, gas heater, gas light." Few even will know of the gas water heater, that ought to be in every modern home. Tell the average factory man that there are a hundred efficient uses for gas in his business, and he will be amazed.

I am a fairly intelligent and alert observer of advertising because that is my business; and the advertising of gas appliances has not made on me the impression that so important a subject should make. If I, an advertiser, have not been "sold" by your advertising, how small a part of the public has been sold? I believe that you gas men have only begun to scratch the surface; and that the public does not begin to realize the comfort, convenience and economy that will come to them in the enlightened use of gas.

Some of your literature carries the expression "the right way is the gas way." At the same time I read in the newspapers this week—"Do it the electric way;" Electrical Prosperity Week is being celebrated all over the country.

You are facing hard competition. Whether or not you "yield anything to electricity," you must face its competition, and of oil, as well, in industrial plants. You cannot hide your head in the sand and refuse to see the changing conditions of the day.

The right way is the gas way only if it *is* the right way—only if your product is supreme in the field of light, heat and power. Are you sure your product is as good as you can make it? Are your gas appliances as good as they can be?

This is the age of standardization. I am told there are in the Unites States approximately a hundred makers of gas cooking stoves. There must be at least scores of many of the various kinds of gas appliances, each competing with the other? Suppose you could take the best features of each and produce a thoroughly standardized and efficient product! The automobile has been improved so fast because it has been standardized. Gas appliances can be standardized in the same way. With standardized products you can rightly educate the people in the use of those products. The right way to educate the people is to advertise intelligently to them—to advertise persistently, patiently, efficiently.

The right way to make known the "gas way" is through efficient merchandising and efficient advertising. And these are efficient only as they render true service to the public.

Efficiency for service is the watchword of all modern successful businesses. Service to the public; efficiency within the organization.

Without due regard to the rights, demands, desires, needs and uses of the public, efficiency avails not.

Without efficiency, true public service, lasting public service, just public service is impossible.

Without both service and efficiency, a business of any kind cannot long continue on a paying basis in this age of keen competition.

Nature has ordained the survival of the fittest. Business, based on nature and made up of human elements, lives and dies on the same principles.

The "gas way" will continue to be the right way only so long as it is the efficient way—the fittest way. Lack of an efficient standardized product, lack of efficient organization, lack of efficient merchandising, lack of efficient distribution, lack of efficient publicity, lack of justice to the public; or the development of a more efficient vehicle for light, heat and power, will send it to the scrap pile of once useful but now useless agencies of man, superseded by something better.

You can't control, you would not if you could, new discoveries and new inventions for the good of all the people. They come at any moment, unheralded, eagerly welcomed.

You can control everything else in your business.

I leave the discussion where I began it—to your consideration—with the two greatest words of any business; Efficiency and Service.

Measuring Air and Steam to Water Gas Sets Not Patentable.

About 3 years The United Gas Improvement Company brought suit against The Gas Machinery Company, charging infringement of the Rusby Patent No. 857,760, covering the attachment of an air metering device to a water gas apparatus, and the Dickey Patent No. 940,925, for the attachment of a steam metering device for water gas apparatus.

The case was tried before Judge Day in the United States District Court, at Cleveland, O., in the latter part of 1913, and in deciding the case the Court held that the Dickey patent was invalid; but that the Rusby patent was valid and had been infringed by nine water gas sets which The Gas Machinery Company had installed provided with Pitot tube air meters.

The Gas Machinery Company appealed from the decision in so far as it related to the Rusby patent, and the Court of Appeals for the Sixth Circuit has just handed down its decision on the appeal, reversing the lower court, and holding that the Rusby patent also is invalid. The reason stated by the Court for holding the Rusby patent invalid is that it discloses an unpatentable aggregation of old elements, and not a patentable combination of co-acting elements. Concerning this particular point the Court says in its opinion:

"We conclude that the relation of Rusby's ajutage and gauge to the "set" is the relation between the items of an aggregate, and not the relation between the elements of a combination. This conclusion depends on the general proposition that a metering device, the only office of which is to measure the raw material entering a machine so that the operator may stop when he has put in enough, does not so co-act with the machine itself as to be properly characterized as being in combination therewith.

"The operation of the ajutage is as obscure as its name is unfamiliar, but in spite of that, it does nothing excepting to indicate, and, in a sense, measure the entering air. It does not co-operate with the three main members of the set any more than does the oil measuring device or the steam measuring device, or, for that matter, the scales that weigh the coal. Indeed, it is just as important to the operator to know the period of elapsed time as it is to know the rate of flow of the air, and the clock that tells him when to close the valve fully, is as essential to the gas making operation as is the gauge which tells him when to shut it part way. It is only another form of expressing the lack of real combination to say that the gas making apparatus does not extend beyond the gates at which the materials enter, and it is only fortuitous that the air measuring device happens to be set close to the entrance valve. It might as well be in another room.

"Upon principle, it seems clear to us that a mere measuring device, which does nothing and can do nothing except to give the operator information as to how much material is going into the machine, is no part of a true combination of the operative elements of the machine; and we can find no case where the contrary has been held."

BRITISH PRACTICE IN THE PURIFICATION OF COAL GAS.

By J. FERGUSON BELL, Past Vice-President of the Institution of Gas Engineers; Engineer and Manager of the Derby Gas Light and Coke Company, to the International Gas Congress.

The purification of coal gas in closed vessels, by one of its so-called impurities—ammonia—is theoretically an ideal system, but so far has not fulfilled expectations, although many attempts have been made.

In the F. C. Hill's process, which consists of heating crude ammoniacal liquor to within a few degrees of boiling point, the bulk of the acid gases, hydrogen sulphide (H_2S) and carbonic acid (CO_2) held in combination with ammonia (NH_3), are for the most part liberated, leaving free ammonia to be utilized to remove the sulphureted hydrogen and carbon dioxide from the crude gas. This process was elaborated and modified by Claus, who ultimately succeeded in effecting entire purification of coal gas in closed vessels, by combining the acid and alkaline impurities to form soluble salts, to be taken up in a series of scrubbers. The Claus system of purification was tried at Birmingham in 1883, in an experimental plant capable of dealing with 250,000 cubic feet of gas per diem. The results obtained were so promising, that the late Mr. Stelfox, of Belfast, advised in 1886 the erection of a plant on the Claus system, calculated to deal with 2,500,000 cubic feet of gas per diem, but after an extended trial over 7 or 8 years, the process was finally discontinued, because of uncertainty of action and loss of ammonia. It could not be relied upon to remove on the average more than 60% of the total impurities. The result was that this fascinating and theoretically well founded system has not so far displaced the older, if less scientific system, for removal of CO_2 and H_2S.

Until recent years, lime was very generally used, either exclusively or in conjunction with oxide of iron, for removal of the impurities in coal gas, but in consequence of the difficulty in disposal of the spent lime, and also the repeal by Parliament of sulphur restrictions other than sulphureted hydrogen, lime has been largely replaced by hydrated ferric oxide.

LIME PURIFICATION.

The action of slaked lime ($2Ca(OH)_2$) on carbon dioxide (CO_2) and hydrogen sulphide (H_2S) is expressed by the equation—

$$Ca(OH)_2+CO_2=CaCO_3+H_2O$$
$$Ca(OH)_2+H_2S=Ca(OH).(SH)+H_2O$$

The lime at first absorbs both carbon dioxide and hydrogen sulphide, forming calcium carbonate ($CaCO_3$) and hydroxy-hydro-sulphide ($Ca(OH).(SH)$). Later, in consequence of the greater affinity of lime for carbonic acid, the hydroxy-hydro-sulphide is decomposed, forming calcium carbonate, liberating hydrogen sulphide thus:

$$CO_2+Ca(OH).(SH)=CaCO_3+H_2S.$$

The sulphureted hydrogen being driven forward into a clean lime vessel forms sulphide of lime, which will absorb carbon bisulphide (CS_2) forming calcium sulpho-carbonate and sulphureted hydrogen, the reaction being approximately expressed by the equation:

$$2Ca\ (OH).(SH) + CS_2 = CaCS_3.Ca\ (OH)_2 + H_2S.$$

In large works, where the lime process is used, there are either separate vessels to remove each impurity, or sets of six purifiers, the first four being lime vessels, and the last two oxide. In either case special care is required to keep the calcium sulphide active for removal of CS_2, otherwise the sulphur impurities may be increased instead of reduced. Under the best conditions, to supply gas with a 20-grain sulphur penalty limit, proved so difficult by any then known method, that the sulphur restriction clauses in various gas companies Acts of Parliament were gradually repealed, and in no case where the gas supply was in the hands of a local authority were they ever made compulsory, it being considered that the reduction of residuary sulphur by the lime process operated injuriously to gas suppliers, without securing a commensurate advantage to consumers.

For efficient purification by lime, purifiers of small unit capacity, suited to the quantity of gas made, give the best results; for if gas is passed through too slowly, the temperature may be so reduced as to retard the necessary reactions. The material then comes out patchy, not fully spent. The lime should be thoroughly slaked and allowed to stand several days to become well cooled before being used.

With a set of four lime purifiers, each 32 feet x 16 feet x 4 feet 6 inches deep, the writer continues to purify 1,000,000 to 1,250,000 cubic feet of gas per diem, removing the CO_2, SH_2 and reduction of CS_2 to an average of 18 grains per 100 cubic feet; the impurities in the crude gas entering the purifiers being:

Carbonic acid, (CO_2)..... = $2\frac{1}{2}$ to $3\frac{1}{2}$% by volume.
Sulphureted hydrogen, (SH_2) = 700 to 1,200 grams per 100 c. f.
Sulphur compounds, (CS_2)... = 30 to 70 grams per cubic foot.

This lime purified gas is mixed with that treated with oxide only, and so reduces the percentage of carbon dioxide and residuary sulphur in the mixed gas.

OXIDE PURIFICATION.

The facility with which sulphureted hydrogen can be removed from crude gas by hydrated ferric oxide, and as residuary sulphur in other forms is no longer compulsorily restricted, natural or artificially prepared hydrated oxide of iron is now very generally used instead of lime.

The action of hydrated ferric oxide in removing sulphureted hydrogen is expressed by the following equation (a portion of the ferric sulphide formed breaks up into ferrous sulphide and free sulphur):

$$Fe_2O_3.H_2O + 3H_2S = Fe_2S_3 + 4H_2O$$
$$Fe_2O_3.H_2O + 3H_2S = 2\ FeS + S + 4H_2O$$

The oxide when it ceases to absorb sulphureted hydrogen, may be revivified by air, the ferric sulphide being decomposed by oxygen with the evolution of heat, yielding hydrated ferric oxide and sulphur thus:

$$Fe_2S_3 + 3O + H_2O = Fe_2O_3.H_2O + 3S$$
$$4FeS + 3O_2 + 2H_2O = 2Fe_2O_3.H_2O + 4\ S.$$

Oxide thus revivified is fit for use again, until the sulphur contents reach 50%, when it is usually sold for acid making.

In addition, the cyanogen in the gas forms ferro and sulpho-cyanides, the former a product of some value, depending upon the price of Prussian blue.

The purifying value of oxide depends not only upon the percentage of hydrated ferric oxide ($Fe_2O_3.H_2O$), but also upon its physical structure and moisture contents.

The author finds the addition of $1\frac{1}{2}$% to 2% of air may be added to the second purifier of the series without any noticeable reduction in candle power. This, with daily reversal flow of gas on the back rotation system, lessens the number of changes by one-third.

Revivification in *situ* may be conveniently effected by a small rotary air blower, worked from the exhauster or small separate steam driven blower, with index counter and rotary air meter to measure the exact volume of air admitted. Oxide purifiers often require to be changed simply because of excessive back pressure. With "Milbel" grids the area of surface oxide exposed is doubled, and the weight of oxide in purifier may be increased 50% with reduced back pressure.

If the oxide is very active, it is necessary to avoid accidental admission of air, which may cause excessive heating, with production of carbon bisulphide. The main inlet and outlet of the oxide purifiers should be daily tested for this impurity, and before emptying an oxide purifier, clean gas should be put through it to remove the foul gas and so reduce toxic action of gases given off.

In the larger works a horse-drawn plough is sometimes used for turning and breaking up the oxide, but a much better plan is to use a mechanical breaker. By passing the oxide through a disintegrator, it is broken into a course powder, whereby it is better aerated, and subjected to a degree of oxidation impossible by turning over with a plough or shovel.

Weldon mud, a by-product in the manufacture of bleaching powder, which is a hydrated peroxide of manganese ($MnO_2.MnO + H_2O$) was used for taking out the last traces of sulphureted hydrogen, but its avidity to absorb carbonic acid and become inert to H_2S, together with its high first cost, prevented its extended use.

CARBONIC ACID (CO_2).

This is simply a deterioratory diluent of coal gas. One per cent. by volume, reduces the candle power by about $3\frac{1}{2}$%, the loss in

(*Continued on page 42.*)

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Increased Production and Higher Prices.

The report of the U. S. Geological Survey on the production of petroleum in 1915, published in the JOURNAL of last week, shows the largest production of crude petroleum ever recorded, and a progressive increase in price during the latter half of the year. This price increase has, of course, raised the cost of refined products, and it is reported that steps have been taken to inaugurate a government investigation of the prices charged for gasoline and for gas oils. The cost of gas oil is also to be examined by the Public Service Commissions of New York, as related to gas prices.

Eastern oil refiners, commenting on the figures published by the Geological Survey, say the increased prices are justified by a marked decrease in the last half-year production, and a continued falling off since in the higher grade crudes. Here is where some of the new processes for controlling yield of products should work to the advantage of consumers. Will they?

Regulation Upon Regulation.

The address of Mr. L. A. Busby before the Chicago Section American Institute of Electrical Engineers, while covering particularly the experience of the Chicago street railway, calls attention to the unreasonably multiplication of regulation of public utilities. He said, in part:

"The Chicago Surface lines are regulated by the municipal authorities in several different ways. In accordance with the terms of our contract we have agreed 'to comply with all reasonable regulations of the service, which may be prescribed from time to time by the city council.'

"The city council acts, in the first place, through its local transportation committee, aided and abetted by an equally active and persistent transportation supervisor. The city council has not failed to avail itself of its rights of regulation, and is dealing with almost every possible service question.

"But this is only the *beginning* of our regulation. After the city council, we come under the jurisdiction of many municipal departments. There is the *commissioner of health*, who has to do with heating, ventilation and sanitation of cars; we are controlled to a considerable extent by the *commissioner of public works*; and finally by the *commissioner of public service*, who deals with service complaints of all kinds, and has, at all times, a large force employed in checking up our service.

"We are now only well under way in this matter of regulation. We have yet *seventy aldermen*, representing thirty-five different wards of the city, and each alderman has the transportation interests of his own particular ward to look after in addition to the transportation needs of the city.

"And working along the same lines there are several score of neighborhood or improvement associations, who stand ready to join with all and singular the regulating agencies mentioned herein, in ordes to procure some local benefit or advantage.

"We now come to the *Board of Supervising Engineers*, a board of experts created by the 1907 ordinance On this board the city has a representative, the companies have a representative and the third member is our honored chairman, Mr. Bion J. Arnold.

"This board has a wide general supervision over the affairs of the company; it has control over construction, reconstruction and rehabilitation of track, roadway and equipment, and all contracts therefor; passes upon our capital renewal, and to some extent upon our operating accounts, carefully checking all expenditures made by the company, with a view of determining whether those expenditures come within the various provisions of the ordinances; and finally the board has the extremely important duty of passing upon the reasonableness of the service regulations prescribed from time to time by the city council. This board is constantly appealed to by the city council or its local transportation committee, for advice and recommendations with reference to various matters.

"But the end is not yet. Two years ago the State Legislature passed an act creating a *State Public Utilities Commission*, and about a year ago it assumed jurisdiction over the service of the street railways of Chicago. This resulted in an order by the commission last September, covering generally the whole field of service, involving a standard of service, the routing of cars, the class of equipment to be operated, car signs, etc.

"Among other things, the commission ordered the company to operate trailers, the use of which is prohibited by the terms of our ordinance. Regardless of the merits of the question, this part of the order produced a somewhat novel situation, in that if we were to comply with the order of the commission, with reference to the operation of trailers, we would subject ourselves to forfeiture of our street rights and franchises; and if, on the other hand, we failed to comply with the order of the commission, the company would be subject to a fine of not to exceed $1,000, or imprisonment not to exceed a year in the county jail, or both fine and imprisonment. This matter is now in the courts.

"This multiple regulation has resulted in a great waste of time, not only on the part of public officials, but by officers and employees of the company."

And all this waste and expense is ultimately paid for by the consumer, the company's burden being mainly the annoyance from the unnecessary interference.

The Delusion of the Sinking Fund.

An editorial in "Engineering News" takes up the question of depreciation along this line:

"If a utility company is to recover the loss of capital caused by the depreciation of its plant, the customers must pay for it in the rates charged them for service. This is clear; it is equally obvious that there is no way to lessen the amount the customers must pay—if the company recover the loss *in full*. Yet many people, including such an eminent man as Halford Erickson, of the Wisconsin Commission, claim there is a way in which this miracle has been and can be accomplished.

"There are two general plans followed in this country in extracting indemnity for depreciation from the customer's pocket. First, the direct-repayment, or "straight-line," schemes, which aim directly to repay the company for the actual annual loss in impaired capital. The second, or "sinking-fund," plan takes out of earnings an annuity which would, if put into a true accumulating sinking fund, equal the cost of the depreciating property when discarded. If both plans really cover the depreciating loss, either one must cost the customers the same as the other. Claiming

that one plan is cheaper than the other is only a trick in words or in bookkeeping.

"We may see what the trick is from a few of Mr. Erickson's remarks in a paper before the recent Philadelphia Valuation Conference:

"'Without going into details, it can be said that the sinking-fund method employs a more efficient use of the reserve (than the straight-line plan). Because of such use, the amount the consumers will have to contribute to cover depreciation is less than under the straight-line method.

"'Where the amounts so provided have been used for necessary proper renewals and for the accumulation of a reserve for covering the accrued depreciation of the property still in use, no reduction from the cost new, because of depreciation, should be made in determining the fair value for rate making and certain other purposes.'

"All that Mr. Erickson and others do, is to ask the customer to pay more for interest on capital and less for depreciation. The total is unchanged. The "sinking fund" annuity is less than the actual annual depreciation loss, and the discrepency is recovered in interest on a plant value larger than the actual present figures.

"If the matter ended there, this use of the sinking fund computations would harm no one. But the United States Supreme Court has ruled (City of Knoxville vs. Knoxville Water Company, 29 Sup. Ct. Rep. 148) that the company each year is entitled to recover a dollar, above interests and profits, for each dollar by which the plant that year has lost value in service, while present (depreciated) value must be the basis of rates. It is immediately seen how Mr. Erickson's views run counter to the court's dictum, in that he does not openly, year by year, give a company sufficient indemnity for depreciation losses, and in that he includes a nonexistent and lost element in the value of the plant. It would clarify all our ideas if we abandoned sinking fund talk, and stuck to the simpler direct annual prepayment plans for computing the customer's burden.

"The objection that many have held against straight-line or direct-repayment plans of handling depreciation reimbursement, has been that the early repayments were larger that the real depreciation, and in the later years smaller. But the direct-repayment plan can be handled so that depreciation and the repayment therefor go hand in hand. That was done a few years ago by Frederic P. Stearns when he developed his "equal-annual-payment" plan. Briefly stated, each annual compensation is made numerically equal to a hypothetical sinking fund annuity plus the interest accretion of a hypothetical reserve fund. The customers are loaded with exactly the same costs as under the procedure indicated by Mr. Erickson, but everything is correctly labeled, delusions are dissipated, and the law is satisfied."

For a Permanent Tariff Commission.

In advocating this reform as a national business policy—the Chamber of Commerce of the United States says, in a pamphlet just issued, that the proposal is not in any way political. Before the tariff revision of 1909 was determined upon, a commission was urged by advocates regardless of party. Every time there has been an attempt in either House or Senate to make it a party measure there have been affirmative votes from among the opposing party.

In 1911 the House Committee on Ways and Means—the committee in which party lines are most closely drawn, and which bears the burden of the present method of formulating a new tariff—unanimously approved a bill for a permanent commission. Champ Clark, at that time the minority leader of the House, said: "The demand for such a board is insistent and increasing. In fact, it is widespread and, in my judgment, should be heeded."

For sixty years the tariff has been a source of constant friction between government and business. Whatever the tariff policy determined by national elections, its application by Congress has been accompanied by controversies regarding the facts of industry and commerce. As these facts have never been authoritatively ascertained, except in a few instances, business men find the prosperity of their enterprises and that of their employees menaced by legislation based upon inaccurate and incomplete data. Under such conditions, consideration of new tariff legislation inevitably causes apprehension and uncertainty throughout the entire business world. In calling Congress into extraordinary session for the last revision of the tariff the President declared that among his purposes was a desire "that the business interests of the country may not be kept too long in suspense as to what the fiscal changes are to be to which they will be required to adjust themselves."

"A periodic unsettlement of the material progress of the country without reason or explanation in economic conditions, imposes a burden repungent to every dictate of business efficiency and every principle of statemanship. The frequency with which these dislocations of conditions occur is indicated by the dates of recent enactments—1890, 1894, 1897, 1909, 1913. All of these enactments affected, not one industry but the entire range of American industrial and commercial enterprise, and worse still, these laws establish no discernable rule of general applicability, while every one of them has been criticized on the ground that it contains gross discriminations against particular industries and grants corresponding abnormal advantages to others.

"Tariff legislation as now conducted gives rise to more irritation, to more suspicion of legislative willingness to discriminate for local or private interests, and to more undemocratic procedure than any other thing in American life."

To prevent these disturbances, which have no excuse in any orderly system of national government, a permanent tariff commission is advocated. At the first annual meeting of the Chamber of Commerce of the United States, in 1913, about 350 delegates from constituent organizations in some forty States, adopted resolutions urgently advocating a commission. In the spring of 1913, in a referendum among the 343 commercial organizations then in the membership of the Chamber, the votes cast were 715 in favor of a commission and 9 opposed; each organization was entitled to from 1 to 10 votes according to the number of its membership. In 1915, the delegates in the Third Annual Meeting unanimously reaffirmed that position.

"Whatever the policy Congress means to pursue, the tariff should be fixed by facts," is the conclusion of the National Chamber pamphlet. "The legislative function is to apply a policy to facts. A permanent tariff commission would, for the first time in the history of the country, ascertain the facts authoritatively, make them as well known as the legislative policy that is to be applied to them, and so enable Congress to give to tariff legislation the definiteness which should be the first requisite of all legislation."

Municipal Ownership Refused.

Two small towns, San Angelo, Tex., and Port Vue, Pa., are reported to have refused to accept as free gifts the plants of their public utility companies. Even if the plants themselves were not profitable as operated, the refusals indicate a change in public sentiment. All the people do not think municipalities can do better than private management.

"The president and owner of the street railway company at Port Vue, Pa., has offered the street railway and its franchise to the city, on condition that the municipality continue to operate it for a period of five years. The city council of Port Vue refused to be stampeded by the offer, but referred the matter to a committee, which has recommended that the offer be rejected, and the present owner be compelled to continue the operation of the line and pay the losses out of his own pocket.

"J. D. Sugg, the owner of the street car line in San Angelo, the prosperous capital of Tom Green County, Texas, recently offered to make the city a Christmas present of his property. He attached no harsh conditions about the future operation of the property, but offered it as an outright gift. The property was conservatively estimated to have a value of $200,000."

(Continued from page 39.)

British Practice in the Purification of Coal Gas.

candle feet being 2½%. As the specific heat of carbon dioxide is high, its presence reduces flame temperature by a greater degree than percentage added, and calorific value is reduced pro rata. It is, however, an economic question to be decided in each case, if the gain justifies the cost of its removal by lime, as flame luminosity is not now the predominant criterion of the quality of gas supplied.

Sulphur Compounds.

The residuary sulphur, chiefly carbon bisulphide (CS_2), is a noxious impurity, and should be reduced, as its effect in gas when burnt is exactly similar to that of H_2S, which is rigidly prohibited.

All kinds of glass are attacked, if the gas is imperfectly purified from sulphur compounds, and the white flaky deposit on the under side of copper or brass vessels consist chiefly of copper sulphate, and the same applies to iron or zinc. In addition, the sulphurous gas produced is so objectionable that it hinders the use of gas, especially for interior lighting.

The most notable advance in purification of recent years has been made by Dr. Chas. Carpenter in conjunction with Mr. E. V. Evans, chemist of the South Metropolitan Gas Company, the "Purification of Gas by Heat." The gas is preheated to a temperature of about 400° C., then passed through externally heated tubes containing fire clay balls impregnated with nickel salt, which, heated to a suitable temperature, promotes catalytic action in the presence of hydrogen at a temperature of 450° C., and produces decomposition of the CS_2 thus:

$$CS_2 + 2H_2 = 2H_2S + C.$$

By this process, with a plant capable of dealing with over 10,000,000 cubic feet of coal gas per diem, the sulphur contents are reduced by 80%, at a cost of just under one-third of a penny per 1,000 cubic feet, including working expenses, depreciation and interest on plant.

The credit for successfully applying heat reaction to decompose CS_2 on a large working scale belongs to Hall and Papst of the Portland Gas and Coke Company, Portland, Oregon, U. S. A. Their plant consists of two reheaters each being a column filled with checker firebrick, and small gas producer by which the reheaters are alternately heated, and operated intermittently. The temperature required for this process is 700° to 900° C., whereupon 70% of the CS_2 present is decomposed.

Another promising process is that of Guillet of France, in which the gas containing moisture is passed through oxide of iron heated to a temperature varying from 80° to 200° C. The CS_2 is decomposed according to the reaction:

$$CS_2 + 2H_2O = CO_2 + 2H_2S.$$

Purifying Plant.

For many years purifiers were constructed of cast iron plates, 4 to 6 feet in depth, with water lutes varying from 24″ to 36″ in depth; the movable cover that was of steel plates, riveted to a trussed framing sufficiently strong to withstand the interior gas pressure and the lifting of the cover. This type of purifier has been almost entirely discarded, for the more compact and economical form of luteless purifier, for which we are indebted to the late Mr. Henry Green of Preston, who was the first to make a rectangular vessel formed of cast iron plates, with one, two, three or more division plates to form separate boxes, the top being constructed of cast iron plates, with suitable openings having light steel moveable covers, the gas-tight joint under the cover plate being made by an India-rubber pad.

Fig. 1, shows end view of top floor of purifying house of Litchurch Gas Works, Derby, which contains eight luteless purifiers each 30 feet x 25 feet x by 6 feet deep, with 24-inch connections and Milbourne's purifier valves. These replaced four separate hydraulic lute purifiers, by which over twice the superficial area was obtained on the same ground space. The purifiers are fixed on five rows of longitudinal 15″ x 6″ steel beams, carried by cast iron columns 14′ 9″ high; the floor below being utilized for revivifying the oxide. Each purifier has four openings on top, with light framed steel covers secured to the cast iron flange curb by "Milbourne's" patent rapid cover fasteners, which enables the cover to be fastened or unfastened on all four sides simultaneously at one operation by a hand lever. The covers are moved by a light traveling chain block running on a bottom flange of steel joist carried by lattice cross girders. The oxide is raised from ground floor by a bucket elevator, delivering on a traveling band conveyor. A throw-off and canvas shoot discharges the material into the purifiers.

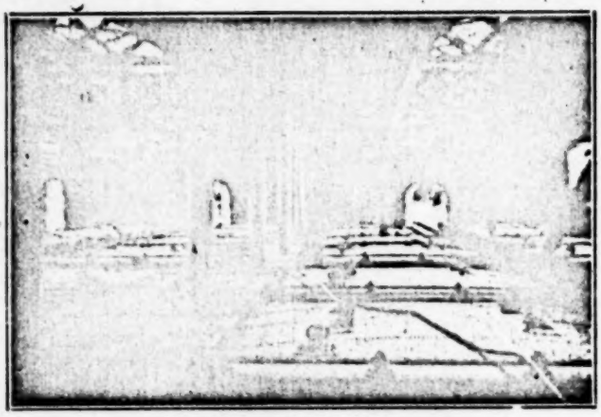


Fig. 1.—Litchurch Purifiers (top floor).

Fig. 2 shows ground floor, with 24″ inlet and outlet connections; and four 18″ diameter bottom discharge shoots to each purifier, with self-sealing lid and lever fastening, with pipes inside of box in short socket lengths, and cover on tops.

The gas inlet and outlet valves are bolted on the inside of each purifier, arranged so that one, two, three or four purifiers may be worked in rotation, or the whole set can be by-passed. Each set of four boxes is worked in parallel.

If there is plenty of room, purifiers erected on the ground with oxide revivifying and storage sheds on each side is an economical structural and convenient arrangement, especially for medium sized works. Fig. 3 is a view of a set of four luteless purifiers in line, each 25 feet x 20 feet x 5 feet deep, with two openings on top of each box 10′ x 17′ 6″, recently erected at the Belper Gas Works, Derby. The covers are fitted with automatic rapid fastener, lifted and moved by a light double-jib traveling crane running on narrow gauge rails, fixed on the top plates forming the center gangway of purifiers. The 14″ diameter inlet and outlet connections run alongside of boxes, with Milbourne duplex valves bolted on outside of purifiers, which are so constructed that the valve discs are accessible at any time and can be examined without interfering with the purifiers or connections. There is a light, open three-span shed over the purifiers with oxide revivifying and storage shed 20 feet span on each side, running parallel with the boxes.

Below is a tabulated list of purifiers, ranging from 10 feet x 10 feet x 5 feet deep to 40 feet x 40 feet x 6 feet deep, giving weights of boxes, covers and bearers, and valves and connections:

No. and size (feet).	Diameter of connections (inches).	Valves bolted direct to purifiers.	Weight of boxes (tons).	Weight of covers and bearers (tons).	Weight of valves and connections (tons).
4—10 x 10 x 5	8	Inside	20	2½	5½
4—12 x 12 x 4½	10	Outside, duplex	27	5	8½
4—15 x 15 x 5	12	Inside	39	6½	10
4—20 x 20 x 5	14	Inside	74	11¼	10
4—25 x 20 x 5	16	Outside, duplex	73	13	12
4—25 x 25 x 5	18	Inside	100	15	22
4—30 x 25 x 6	18	Inside	121	26	56
4—30 x 30 x 6	24	Inside	138	29½	56
4—40 x 30 x 6	24	Outside, duplex	188	35	50
4—40 x 35 x 6	24	Inside	212	32	43
4—40 x 40 x 6	24	Outside, duplex	248	52	58

With regard to the design of purifiers, it is advisable wherever possible, for the length and width of purifiers to be multiples of 5 feet. The flanges of top plates should be arranged inside the purifiers, as this leaves the top platform or gangways clear of obstruction, and the side plate flanges should be external, to avoid having special sieves. It is usual to have external flanges on the bottom plates when purifiers are erected on girder platform, and internal flanges when they are erected on brick or concrete flat bed foundations.

The flanges should be 2½″ deep clear of the plate, jointed together with ¾″ bolts, with round bolt holes 6″ centers, having brackets 6″ apart, spaced equally between the bolt holes.

Small purifiers up to 12′ square may be 4′ 6″ deep. Above this and up to 700 square feet area, 5′ deep, while purifiers above this area should not be less than 5′ 6″ or 6′ deep.

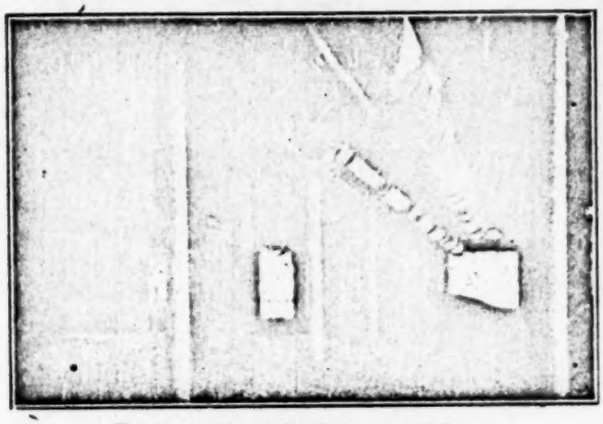


Fig. 2. -Litchurch Purifiers (ground floor).

When oxide is used as the purifying agent, it is usual to provide only two tiers of sieves and bearing bars, but with lime, four tiers at least are necessary. All purifiers should be prepared for not less than four tiers, although intended for oxide purification, as conditions may necessitate the use of lime or other purifying agent at some future time.

The length of the wood grids should equal the width of side plates forming the purifier, that is to say, either 4′ or 5′ and the width of the sieves should be 2′ where this is suitable. It is not advisable to exceed these lengths and widths. Rubber pads are preferable to hemp gasket rings for making the joint between the cover and purifier

The bearing bars for sieves should be tee section of convenient lengths for handling, the span being arranged proportionately to the depth, by the introduction of intermediates C.I. standards.

The purifier connections will be influenced by the size of existing pipes on works, but when new purifiers are erected, it is desirable for the inlet and outlet connections to be large, the approximate size may be determined by formula;

$d = \frac{1}{3}(L + B)$

d = diameter of connections in inches.

L and B = length and breath of purifier in feet.

Reliability of the valves controlling the flow of gas through a series of purifiers is an important factor in the efficiency of purification. A slight leakage of unpurified gas, in consequence of a faulty valve, may cause serious trouble; hence the importance of purifier valves being gas-tight and accessible for adjustment

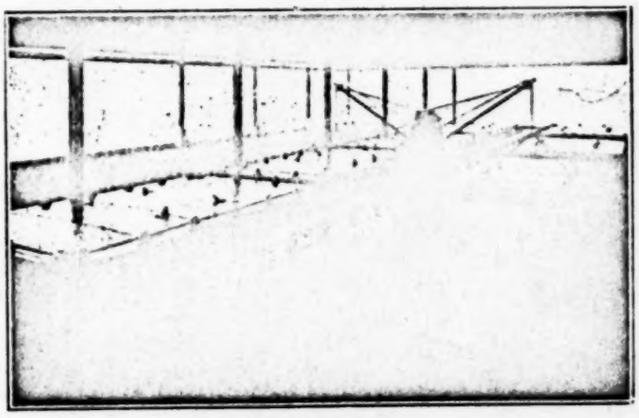


Fig. 3.—Belper Purifiers.

For many years hydraulic center valves were employed to operate a set of four purifiers, three on and one off. These were cumbersome; a slight leakage occurred each time the valve was turned, and any great excess of pressure was liable to cause serious trouble by blowing off the hydraulic seal. Hence dry-faced centre valves largely superseded the old hydraulic form of valve. The objection to this type of valve is the large surface required to be made and kept gas-tight. In case of leakage the whole set of purifiers require to be put out of action for the valve surfaces to be scraped and made sound.

We are indebted to Weck for an original and decided advance in the construction and working of purifier valves, adapted to work one, two, three or four purifiers in rotation, provided the gas is passed in one direction. This valve consists of a combination of valves fitted in one body and so arranged that they control the flow of gas to and from the purifiers, working one or more boxes in series.

Fig. 4 illustrates a Weck valve suitable for working four purifiers. The main inlet and outlet can be placed in any of the portions marked. The sectional elevation shows that the body of the valve is divided horizontally into two compartments. The bottom section is divided into four compartments, and the upper section into eight compartments, each opened and closed by a double faced disc valve, arranged so that the disc up or down forms a gas-tight joint against a knife-edge seating top and bottom; thus each forms a two-way valve.

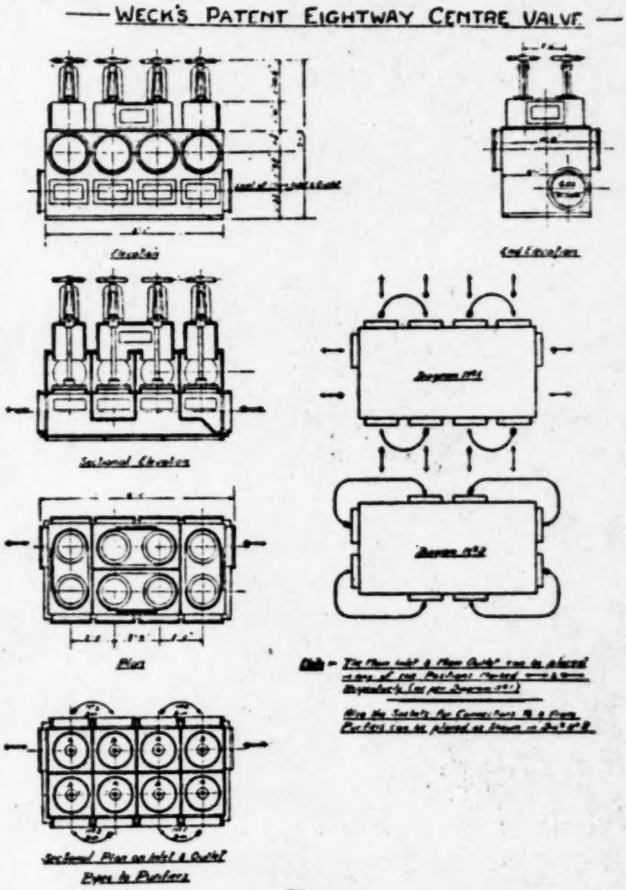


Fig. 4.

The Weck valve was the beginning of a new departure in purifie valves.

The Pickering valve is a modification of the Weck. The disc valves and spindles work horizontally instead of vertically, which enables the valve to be bolted direct to the under side of the boxes, or connected thereto by short pipes.

Milbourne's purifier valves for bolting on the inside of the purifiers, and duplex outside valves to bolt direct on to the side plates of purifiers are also skilful adaptations of the Weck principle, designed to simplify purifier valves and make them more accessible; the latter render the whole of the interior of purifiers available for purifying material.

The "Triumph" valve is bolted direct to the outside of the purifier plate, which is ingenious and simplifies the working of a set of purifiers. There are two valves bolted on the outside between the division plate in the boxes.

These indicate the advances made in recent years in the construction and working of purifier valves. They have simplified and added to the reliability of the valves, which is of the utmost importance in any system.

The author has endeavored to give a general outline of the system and method of purification now generally adopted in the United Kingdom, together with a brief description of the latest advances made in the construction of purifiers and appliances connected therewith. Space alone forbids a more extended description of purification.

PROPORTIONAL METERS.

By an Experienced Engineer.

A subject which is now receiving considerable attention from the artificial-gas Fraternity, is the measuring of gas in large quantities. The rapid development of the sale of gas for industrial purposes has brought this issue forward. There are many industrial consumers who use as much as an entire city as a whole, and the measuring of these large quantities of gas is an important factor. In the past, positive meters were used, and in many cases it has been necessary to manifold a large number of such meters. The writer had an experience in which it was necessary to manifold 24 of the largest direct or positive meters obtainable, in order to measure the gas sold for industrial purposes to one manufacturing concern. This installation meant a large outlay of money for meters, fittings, etc. There are many cases of this kind, therefore, an article in reference to proportional meters should appeal to every gas engineer operating in the industrial fuel field.

Until natural gas became a factor in the commercial world, the demand for a meter of large capacity was very small, and the only large capacity meters were those used as station meters in artificial gas plants, but the largest of these, compared to the capacity of many proportional meters, was very small. But with natural gas, came the demand for a meter of larger capacity and small dimensions, also one that would be capable of withstanding a pressure very much greater than ever demanded of a meter of any capacity before. This resulted in the advent of the proportional meter.

The early proportional meters were used to measure water only; the first practical proportional meter used for measuring gas was invented by F. Moore, and the same year, namely 1886, George Westinghouse patented a proportional meter. In the year 1889, F. Y. Youngs patented an improved proportional meter for the measuring of gas, and about 500 of them were manufactured, but owing to the high cost of construction, the manufacture of this meter was discontinued, and it was not until 1897 that the first practical and efficient as well as accurate proportional meter was invented and patented by T. B. Wylie.

This meter, as well as the others, was built solely to meet natural gas conditions, and it was not until 1900 that Wylie brought before the gas fraternity the first proportional gas meter made especially for artificial gas conditions. Since that time there has been many changes in the construction of proportional meters, embodying in their construction the improvements and the suggestions of many of the most prominent gas engineers throughout the United States and Canada.

The early proportional meters were very crude; some had dry tally meters, others had wet tally meters; some needed special conditions, while others needed special sealing oils, etc.; but to-day there are proportional meters made especially for artificial gas which will measure and register gas accurately at all volumes up to their maximum rated capacity, and requiring a minimum amount of attention with practically no maintenance.

The simplest form of proportional meter is a meter with two valves, one proportional to the other, and a tally meter; the valves being controlled by the gas flowing through them. One of these valves being proportional to the other, (in ratios as low as 1 to 10 and running as high as 1 to 2,000) the gas passing through the small orifice, or valve opening, is registered by the tally meter and is proportional to the main body of the gas passing through the large valve opening or orifice. This type of meter is not accurate, owing to the resistance offered by the tally meter stiffening up; and there is no provision made to correct for errors due to the pressure required to drive the tally meter not being constant, as it is not the same when the tally is new as it is when it has been in use for a time. The gumming of the valves or other parts must also be taken care of; some provision must be made on account of the density of the gas not being always the same—that is, if a meter is tested at a low pressure it will require a low pressure to drive the tally (at the same rate of speed,) at a high pressure or greater density the tally will require more pressure to drive it. Therefore, the keynote of accurate proportional registration and measurement of gas, is to maintain the proper relation between the two valves as well as maintain the proper proportional of pressure against or through these valves.

Consequently a proportional meter to be accurate and efficient under all conditions must be constructed with a regulating device to compensate for the variable friction or absorption of the tally. This is done to insure accuracy at the varying rates of flow and at different densities, and to regulate the pressure of the gas on the proportional valves in the meter. Provisions must also be made to take care of the friction in the tally, as it is not always the same for a given rate of flow for the following reasons: The thickening or thinning of the oil in the oil sealed tallies; and the drying out of the diaphragms. All these factors are taken care of in the latest type of proportional meter.

In the past 5 or 6 years many of the larger gas companies have made extensive tests of proportional meters built especially for artificial gas operation, and have in many cases adopted such meters as station meters. In one test, comparing a proportional meter with a standard type of drum station meter, both of the same hourly capacity, the test showed a difference of only $\frac{1}{4}$ of 1%, during the entire test of over 6 months. There have been many other tests made, and some of the larger companies are adopting proportional meters for large industrial consumers; therefore, let us touch on the advantages the proportional meter has to offer over the direct or positive meter.

The smallest type of proportional gas meter especially for station meter service, has a maximum capacity of 30,000 cubic feet of gas per hour, and will occupy less than six square feet of floor space. A standard wet drum meter, with the old style drum, would be 9 feet in diameter to handle same capacity, and would occupy over 88 square feet of floor space. A standard wet meter with a Hinman drum would be 7 feet in diameter, and occupy over 60 square feet of floor space. Proportional station meters are now manufactured with a capacity of 500,000 cubic feet of gas per hour, which is larger than any wet drum meter made. This proportional meter will occupy but 24 square feet of floor space, and considering that a standard meter with a Hinman drum with a capacity of 173,000 cubic feet of gas per hour requires over 300 square feet of floor space, one of the many advantages in favor of the proportional meter is the small space required.

A proportional meter having 30,000 cubic feet capacity per hour will weigh but 850 pounds complete, while a 500,000 cubic foot capacity meter weighs complete but 6,000 pounds. A standard wet drum meter of 30,000 cubic feet capacity weighs 24,000 pounds, and the water it contains will weigh 24,500 pounds, making a total weight for meter and water of 48,500 pounds; while a standard meter with a Hinman Drum of 30,000 cubic feet capacity will weigh 12,250 pounds, and the water in it 11,500, making a total weight for meter and water of 23,750 pounds. A 16 foot meter with a Hinman Drum has a capacity of 173,000 cubic feet of gas per hour, and the meter and the water it contains weighs 231,000 pounds. Comparing a 16 foot wet drum meter, which has a little more than $\frac{1}{3}$ the capacity of a 500,000 cubic foot proportional meter, the weight of the wet drum meter is over 38 times that of the proportional meter. This additional weight means heavy expenditures in regard to foundations, and their size make it necessary to take great care in locating the meter as well as expensive housing for same. A proportional meter, as it requires but a small space and is very light in weight, can be set most anywhere, and makes a cheap, compact and durable installation.

For instance, the most compact form of positive or direct dry gas meter has a capacity of 3,000 cubic feet of gas per hour at 1" absorption, and occupies 3.16 square feet of floor space; and to handle 30,000 cubic feet of gas per hour would require 10 such meters, which, including manifold, would occupy at least 60 square feet of floor space. Comparing this with the floor space occupied by a proportional meter of 30,000 cubic feet of gas per hour capacity, shows a distinct advantage in favor of the proportional meter.

The maintenance is also greatly in favor of the proportional meter. It takes a considerable amount of water, running in and out of a wet drum station meter, to keep it properly sealed, and then there is the danger of rivets and small bolts working loose and drums collapsing. This is all eliminated in the proportional meter. The process of oiling a wet drum station meter is also a tedious as well as difficult procedure. The parts, especially the drums, are not easily accessible, while a proportional meter can be easily and quickly oiled, as all parts are accessible.

There are very few positive station meters that can be used for high pressure work, in fact none of them could be operated at a pressure of 25 pounds or more, but there are some small dry positive or direct meters built to handle 500 pounds working pressure, a pressure which proportional meters will handle with ease.

Owing to its size, the small amount of space it takes up, the proportional meter can be used for many purposes and in many places where it would be impractical to use a positive gas meter. As a station meter the proportional station meter has a field of its own; as a meter for industrial fuel purposes, especially for large consumers, not only is it more compact, but the first cost is greatly in favor of the proportional meter. For high pressure line work and high pressure trunk lines, a proportional meter can be used at a mimimum expense for installation and maintenance. Many engineers are now contemplating districting their distribution lines, and measuring with a proportional meter the gas going into each district, the meters placed in vaults or pits in the streets. In other words the proportional meter of to-day can be used for everything a positive or direct meter can be used for, and also for many other purposes.

Our Fuel Reserves.

One fact about our mineral resources, pretty generally known, is that our total coal reserves are immense—hundreds of millions of tons—and although we are the largest consumer of coal in the world, using nearly 40% of the total world's production, we have as yet consumed but one-half of 1% of the total quantity the geologists estimate in the United States.

If need be, the United States can supply the world with coal. The coal is here, but it is to be hoped that the great bulk of our coal will be utilized at home.

In the past there has been great waste in the mining, transportation, and use of coal in the United States. Much of the mining in the past 50 years was carelessly done, and a large quantity of coal left in the ground in such a manner that the possibility of its future recovery is problematical. Unscientific mining is not entirely to blame, for under the press of unregulated competition, mine operators have been under the necessity of getting the coal out at the least cost and without proper regard to conservation. The apparent limitless extent of our coal reserves has made us prodigal. Coal is cheap in this country, and not until we put a higher value on it will proper attention be paid to its conservation in the ground.

Nearly three-fourths of our coke is made by the wasteful beehive process: the rest manufactured in by-product ovens. Many of the by-product coke ovens built in recent years were not equipped to recover benzol, and are only now equipping their plants to save this valuable substance.

In anthracite coal, the United States stands alone. The supply of this valuable fuel, valued because of its cleanliness both in handling and use, is limited. At the present rate of consumption, the amount of anthracite yet unmined is not expected to suffice for our needs for more than 75 years. Anthracite is likely to become a luxury.

Petroleum.

The world's production of petroleum in 1914 is estimated at 400,500,000 barrels, of which the United States furnishes 66%.

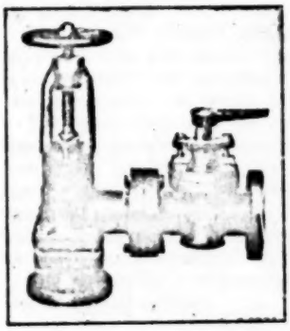
The growth of the petroleum industry in the United States has been accompanied by the invention of new processes and devices and the improvement of old ones, making the industry notable for distinctly American features. Some of these are the construction of pipe lines hundreds of miles long, connecting the wells with refineries and shipping ports; the invention of processes for refining oils of unusual composition; the perfecting of processes by which the percentage of gasoline obtainable from a crude oil is generally increased; the production of gasoline from natural gas; and the manufacture of toluol and benzol from petroleum.

Natural Gas.

The quantity of natural gas commercially utilized in the United States in 1914, is estimated to have amounted to 592,000,000,000 cubic feet, valued at more than $94,000,000.

New Methods and Appliances.

Boiler Blow-Off Combination.—A regrinding and renewable blow-off valve of the angle type has been designed by the Homestead Valve Company, intended for use with the maker's plug cock quarter-turn valves. By using the combination shown in the cut, protection against leakage is secured, and it is possible to close the valve nearest the boiler, and take off the angle valve to be repaired without closing down the boiler.



A Combination of Angle Blow-Off and Quarter-Turn Valve.

The valve has a semi-steel body with a Monel metal valve seat and disk and bronze trimmings. It is designed to give a large clearance for repacking, and when the valve is open the disk is entirely above the valve port. The disk is reversible and can be reground. Loosening the four bolts holding the valve body together releases the seat and enables the disk to be removed. The valves are made in sizes 1¼ to 3" in diameter, for either screwed or flanged fittings.

Costs of 12 and 16 Foot Length Cast-Iron Pipe.—When the manufacture of 16 foot lengths of cast-iron pipe was undertaken by the American Cast Iron Pipe Company, a year or more ago, it was apparently regarded by other manufacturers as a more or less hazardous innovation, and by users of cast-iron pipe as an experiment. Both seem to have been unaware that the 16 foot lengths had long been successfully used in Europe.

The following cost figures, of laying 12 foot and 16 foot length pipe are complete in all details except overhead charges (interest, depreciation of tools, superintendence, etc.).

The wage scale was $4 for skilled labor, $3 for unskilled, and $5.50 for teams, all working 8 hours per day; lead cost $0.0445 and hemp cost $0.05 per pound. The trenches were 20" wide and 28" deep for the 4", and 30" for the 6" pipe. The soil was a sandy loam, shoring was not required, and there was no macadam or payment. The backfilling was done with a scraper and water tamped, and crowning by hand.

Table 1 gives general comparative data of the pipe, and Table 2, field costs for the pipe in place. The figures are for unbroken runs, specials, hydrants and valves being omitted.

Table 1.

Diam., In.	Length Ft.	Approx. Weight per Length, Lb.	Total Lengths, Ft.	Total Weight, Tons.	Cost of Pipe, per Ton. At Shop.	At Destination.
4	12	260	40,000	434.0	$20.40	$33.40
4	16	340	40,000	425.0	21.40	34.40
6	12	400	4,000	66.6	18.40	31.40
6	16	520	4,000	65.0	19.40	32.40

Table 2.—*Costs per Foot Laid.*

	4 in. x 12 ft.	4 in. x 16 ft.	6 in. x 12 ft.	6 in. x 16 ft.
Pipe at destination	$0.3623	$0.3655	$0.5228	$0.5265
Distributing	.0054	.0053	.0083	.0081
Trenching	.0576	.0576	.0600	.0600
Laying and cutting	.0120	.0112	.0184	.0171
Yarn and lead	.0316	.0237	.0431	.0324
Fuel	.0033	.0024	.0046	.0035
Yarning and leading	.0045	.0037	.0067	.0050
Bell holes	.0166	.0125	.0208	.0156
Calking (by hand)	.0062	.0046	.0091	.0070
Testing	.0051	.0048	.0059	.0054
Backfilling	.0216	.0215	.0225	.0223
Totals	$0.5262	$0.5128	$0.7222	$0.7029

Summary of Costs.

Diam., In.	Total Length, Ft.	Pipe Length, Ft.	Cost per Ft.	Total Cost
4	40,000	12	$0.5262	$21,048
4	40,000	16	.5128	20,512
Difference			$0.0134	$536
6	4,000	12	$0.7222	$2,888
6	4,000	12	.7029	2,811
Difference			$0.0193	$77

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

HARRY L. WOLFE, formerly connected with the Peoria (Ill.) Gas and Electric Company, and now with the Rockford Gas Light and Coke Company, has been made travelling industrial gas engineer of that concern. His time will be divided between the companies at Rockford, Kewanee, Waterloo, Iowa and their adjoining territories. Mr. Wolfe is prominent in social and club circles in Rockford, and is at the head of the Elks' lodge.

THE December number of "A Thousand and One Uses for Gas" (issued by the British Commercial Gas Association) is a special drapers' number, and shows how gas is extensively used in the cotton and woollen industries. As an instance, it says this about Bradford: "Altogether two hundred firms engaged in the chief trades of the city, from the washing and combing of wool to the last stage connected with the finishing of piece goods, use large quantities of gas for the lighting of woolcombing sheds, dyeworks, spinning and weaving mills, or for one or other of the various processes of manufacture or treatment for which gas has proved itself of such value. It is computed that for singeing and gassing alone no less than 15,000,000 cubic feet are used in a year. One firm of cotton spinners is a consumer of 1,500,000 cubic feet per annum for these purposes. It is scarcely necessary to add that many mill owners have installed gas cookers for the benefit and convenience of their employees."

MR. THEO. BUNKER, superintendent of the Passaic Division Public Service Gas Company, has been made assistant to Mr. R. R. Young, new business agent, with headquarters in Newark, N. J. Mr. Bunksr's successor is C. J. Roeser, who has been superintendent of the Bergen Division; and that position is now filled by J. U. Killgore, assistant superintendent of distribution in Newark, F. A. Lydecker, of Morristown, being moved to Newark.

THE Citizens Gas and Fuel Company, Terre Haute, Ind., hit upon an ingenious demonstrr ion of the advantages of coke for fuel, during a coke selling campaign. During the month the newspaper space used was devoted to coke, and special window displays introduced to call the attention of the public to the fact that coke is an economic and convenient fuel. To impress the heating qualities of coke on every person who visits the office, the Commercial Department borrowed a base burner stove from a local furniture store, and set it up in the display room close to the front door, and kept a coke fire burning continuously. Deliveries of coke in Terre Haute during the month showed an increase of over 100%, compared with November, 1914, and a much larger business would have been secured had it not been for the continued warm weather.

THE Bailey Meter Company has been incorporated under the laws of Massachusetts to manufacture and sell a line of recording meters and instruments for power plant and other similar uses. The meters have been developed during the past six years in the Mechanical Engineering Department of the Fuel Testing Company of Boston. The Bailey meters are adapted to accurately measure steam, water, air and gases, under all conditions of pressure, temperature and capacity. They include Orifice Meters for all fluids in pipes; V-notch Weir meters for open flow liquids; "The CO_2 Method of Steam and Water Measurement" for meter calibration and testing work; boiler meters, showing steam output, rate of air supply and condition of fuel bed; gas flow meters for fan and ventilating ducts, and radiimeters for averaging all kinds of chart records. This entire line is fundamentally new, and embodies simplicity and durability of construction, and is designed to work satisfactorily and continuously under power plant conditions.

THE H. Koppers Company, has received a contract from the Western States Coke Company, Minneapolis, Minn., for the erection at or near St. Paul of fifty-five $12\frac{1}{4}$-ton cross-regenerative Koppers by-product coke ovens, including benzol apparatus. The Koppers Company will build the plant complete, including foundations coal and coke handling machinery, storage and other departments. The ninety-four by-product coke ovens which it is building for the Toledo Furnace Company, Toledo, Ohio, will be finished about April 15, and will include apparatus to have a capacity of about 6000 gallons of benzol per day.

THE Daytona (Fla.) Public Service Company has made a voluntary reduction in the price of gas to consumers in Daytona, Seabreeze and Daytona Beach. The franchise granted the company by Daytona calls for a reduction when the consumption in the city reaches 20,000,000 feet per annum, but the company concluded to encourage an increased use of gas by making a reduction before the consumption reached half the amount required by the franchise. The new rates will be $1.75 net per 1,000 feet to consumers using less than 10,000 feet per month; those using over 10,000 feet will pay $1.50 for all over 10,000.

FIFTEEN dollars a week did not attract any crowd to the Boston State House to take the competative examination for the position as Deputy Gas Meter Inspector in the service of the Massachusetts Board of Gas and Electric Light Commissioners. Sworn statements of training and experience, an accuracy test, handwriting, arithmetic and report writing, and special questions to ascertain the applicant's ability to test gas meters for accuracy and his knowledge of sealing meters, comprise the examinaiion.

CONSUMERS of gas in Oklahoma City, Okla., have increased in number from 9,468 in 1910 to 12,587 in 1915, an addition of 3,118. Figuring four and one-half persons as composing the average family this means an addition of 15,595 people to the population of the city in that time. The number of gas meters in Oklahoma City each year including 1910 are as follows: In 1910, 9,468; in 1911, 10,611; in 1912, 10,617; in 1913, 10,903; in 1914, 11,636; in 1915, 12,587.

UNLESS the Kansas Natural Gas Company is allowed to charge 35 cents for gas by next winter, Kansas City and other large cities using natural gas will be told to resort to artificial gas, according to J. M. Landon, receiver for the company. "The gas company can go on indefinitely furnishing the kind of service it is giving now, but will not be able to give better service until the company is granted 35-cent gas. It will cost $1,500,000 to extend the lines to new fields, and a raise to even 30 cents will not permit such extensions."

SOUTHAMPTON, L. I., expects that extension of gas mains from Sag Harbor, which has been agitated for some time, will run supplies to the village before next summer. Work on the line from Sag Harbor will probably begin the latter part of March or the first of April.

THE Bellefontaine, O., "Republican," says: "It has been announced frequently within the last couple of years that the Municipal Gas plant is not in good condition, and sooner or later new equipment will be necessary. The Springfield Gas Company has an artificial gas plant that they would like to sell, and it has been offered to this city. Considerable correspondence has passed between present city officials and officials of the company within the past few weeks, and it is understood that a representative of the company has visited the city several times. The equipment of the Springfield company is 15 years old. It seems impracticable that this city should purchase such equipment, tear it down, ship here and reset it."

STEPS have been taken by the Hackettstown, N. J. Common Council to ascertain if the Hackettstown Gas Company, incorporated three years ago, has made application to the Public Utility Commission to have the franchise granted it ratified. The purpose is to ascertain facts with a view to recalling the franchise as it is a hindrance to the granting of another franchise to any other company willing to establish a gas system.

THE Waterbury (Conn.) Gas Light Company has laid four miles of new mains in the city during the past few months, and several miles of old mains have been renewed. The streets on which the new mains were laid are: East Main, Norman, Poplar, Frank, Albion, River, Butler, Bellevue, Robbins, Highland and Rockdale, and on Circuit Avenue. The company is constructing a new holder which will be finished in the spring and which will store 1,500,000 cubic feet of gas.

ANTICIPATING increased demands for gas from improved conditions of business, announcement is made that the Attleboro (Mass.) Gas Light Corporation contemplates considerable additions to its plant during the coming year, among which will be a new gas

holder of not less than half a million cubic feet capacity. In providing for the contemplated improvements the list of shareholders has been enlarged, among those becoming interested in the company being men active in the management of the Taunton Gas Light Company. The efficient organization now employed by that company is to be still further enlarged in the development of the business in Mansfield; and it is believed that it can also be advantageously employed in developing the business in Attleboro, to the mutual benefit of the public and the companies.

SAMUEL E. LINTON, for the past six years superintendent of the Sioux Falls (S. Dak.) Gas Company, has accepted the position of general manager of the Nashville (Tenn.) Gas and Heating Company. He will be succeeded in Sioux Falls by A. S. Graham, formerly of Des Moines, Ia., who is now assistant manager of the Northern Indiana Gas and Electric Company of Hammond, Ind.

IN the controversy between St. Paul and Minneapolis for the new coke-oven plant, the validity of the contract between the Western States Coke Company and the St. Paul Gas Light Company is attacked in court by the American Light and Traction Company of New York, the holding company for the St. Paul concern. In the complaint, it is alleged that the contract for the sale of gas to the latter company stipulated that the coke plant was to be located in St. Paul or vicinity, and that by the location of the plant in Minneapolis proper service to St. Paul gas users cannot be maintained or, at least, might be interrupted.

IN 1841 gas was sold in Baltimore at $4 a thousand cubic feet, with a discount of 12½% for cash. In 1868 the price was $3.30, plus 25 cents per thousand for Government tax (probably due to the Civil War), with a discount of one-eleventh if paid within 20 days. After 1868 the price continued to decrease until it reached $2.50 in 1876. Reductions in the net price in recent years have been as follows:

1900—The price was $1.25 and reduced to $1.10 per 1,000 cubic feet.
1905—The price was $1.00.
1910—The price was 90 cents.
1913—The price was 80 cents.
1916—The price will be 75 cents per 1,000 cubic feet.

To-day there are 124,000 consumers of gas supplied by the Consolidated Gas, Electric Light & Power Company.

UTILITIES COMMISSION NEWS.

GAS PLANT DECLARED A NUISANCE.—Holding that the evidence presented proves that the gas plant of the Utah Gas and Coke Company at Ninth West and First South, Salt Lake City is a public nuisance in that it is so operated as to be obnoxious to people and destructive to property values, Judge T. D. Lewis of the Third District Court handed down a decision ordering that a permanent injunction issue against the operation of the plant.

An appeal probably will be taken by the gas company to the Supreme Court, and if the decision is sustained the company must either move its plant, go out of business or settle the suit by purchasing the property of all plaintiffs.

The decision was given in the case of Hattie G. Kinsman and others against the Utah Gas and Coke Company, bringing to a conclusion a case that has been pending more than two years.

In the trial each side presenting dozens of witnesses, and expert testimony as to the effects of gases and noises, and testimony was given by real estate men as to the values of property in the vicinity of the plant.

The plaintiffs alleged that carbon monoxide and other gases that injured health and caused destruction to plant life and to property were emitted from the plant, and that the noises made interfered with the comfort of people living in the vicinity.

The court finds that the contentions as to the noises, and production of carbon monoxide in quantities to injure health, are not sustained; but it is held that some of the gases emitted caused nausea and headache and affect the mucus membrane. It is also held that gases emitted from the plant are offensive and disagreeable to a degree that the market value of the plaintiffs' property has been depreciated and their homes rendered uncomfortable.

The injunction is not operative until the statutory time for notice of appeal expires.

REPORT OF THE PUBLIC SERVICE COMMISSION OF OREGON.—The Public Service Commission of Oregon in its ninth annual report gives the total number of formal complaints filed during the year 1915 as 130, compared with 141 in 1914; ninety-one of the new matters in the railroad division, and 39 utility matters. New informal utility complaints increased from 177 in 1914 to 204 in 1915.

Of informal utility matters, 229 were handled, 204 being new, 25 pending at date of last report. Informal adjustment was accomplished in 167, 9 were transferred to other docket positions, 5 were discontinued because plaintiffs disinclined to pursue them further, 13 were dismissed as not well founded, and 35 are pending.

Electric rates for light or power were involved in 28 informal utility matters, electric service in 17, gas rates or service in 30, water rates or service in 8, street railway fare or service in 2, telephone rates in 33, telephone service in 61, telegraph rates or service in 2, hazardous wiring in 50. Of the new informal utility matters, 169 were filed by individuals, corporations or associations, and 35 were taken up on the commission's own motion.

Formal utility complaints show 20 dealings with rates and 22 with service, some covering both rates and service. Twenty-nine related to telephone utilities, 4 electric or gas, and 6 water. Twenty-seven formal hearings were held, 34 complaints were closed, and 18 are pending.

The fixed capital as at June 30, 1915, with operating revenue, etc., from July 1, 1914, to June 30, 1915, of the gas utilities in the State are shown in the table:

Fixed capital, June 30, 1915	$12,706,894.76
Operating revenues	1,453,242.48
Operating expenses	672,747.13
Net operating revenue or deficit	780,495.35
Uncollectable operating revenues	7,529.21
Taxes	101,838.30
Operating income	671,127.84

During the year July 1, 1914, to June 30, 1915, extensions, additions and betterments of the various utilities in the State were as follows: Electric, $953,472; gas, $455,414; telegraph, $19,800; telephone, $1,216,724; water, $84,562; total, $2,729,972.

GAS RATE TOO LOW—ELECTRIC TOO HIGH.—The Colorado Public Utilities Commission has handed down an order in the case of the Colorado Springs Light, Heat and Power Company, holding that its rates for electrical energy are excessive and unreasonable. After considering all the evidence in the case bearing upon the value of the plant and the cost to reproduce, the original costs, the investment, the present value, including preliminary and development costs; engineering and supervision, interest, insurance, organization and legal expense during construction, contingencies, working capital and all other elements of value (tangible and intangible), and taking into consideration that the plant is in successful operation and a "going concern," the commission finds the fair value of its electric and hydro property for the purposes of determining reasonable and just rates to be $1,481,762; and that it is earning 12.27% per annum on that value. The electrical engineer of the commission has prepared a schedule of rates, the revenues of which will yield a return in excess of 7½% per annum upon the present value of the property; and it is ordered that this new schedule become effective Jan. 1, 1916.

The commission finds the fair value of the gas property of the company for the purposes of determining reasonable and just rates to be $710,917; and that the company is earning 1.16% per annum on that value. The commission expressed its willingness to entertain a request for an increase in its rates for gas accompanied by evidence sufficient to justify the commission in ordering an increase in such rates.

The present fair value of the steam property of the corporation in use and useful in the sale of steam heat, according to the commission, is $122,774; and there is an annual deficit, which includes $8,000 annual depreciation reserve, in the sum of $13,912. The laws of Colorado pertaining to public utilities and the regulation thereof enumerate by name all public utilities under the jurisdiction of the commission, and the commission has come to the conclusion that it is without jurisdiction in the regulation of the sale of steam.

Financial Notes.

FOR the 12 months ended October 31, 1915, gross of COLUMBIA GAS AND ELECTRIC COMPANY was $8,006,543, an increase of $236,019, or 3% over the preceding 12 months. Total income was $4,444,602, gain of $52,441, or 12% and the surplus, after all deductions, including rentals and sinking funds, was $303,604, an increase of $54,403, or 21.8%. Substantially all the gain in gross and net was made in the last two or three months of the above period, as the greater part of the 12 months was a time of depressed earnings in the territory served by the company, owing to the general business conditions. Cincinnati, until a short time ago, was far below its usual consumption of gas and electric service, and Louisville, which by reason of the fact that natural gas is wholesaled to Louisville Gas and Electric, provides part of Columbia's earnings, also failed to come up to estimated consumption. In addition, practically all other communities served by the company, either with gas or electricity, also felt the effects of the business situation, resulting in reduced earnings for the company. Recently, however, earnings have shown substantial improvement. While the greater part of 1915 has been a time of decreased earnings, the recovery has been such in the latter months that for the calendar year the company should show a surplus of above $400,000, or slightly more than in 1914, when the surplus was $391,037. A proposition made to the Consolidated Gas, Electric Light and Power Company, of Baltimore, to deliver gas at wholesale to that company at the corporate limits of Baltimore, at 28 cents per 1,000, has been turned down. The Columbia interests, however, have not given up the battle for this market for the surplus gas from the United Fuel Gas Company lands, and interesting developments in the matter may be expected. Columbia already has the rights of way for a natural gas pipe line from West Virginia to Baltimore, and arrangements have been made to begin work on the pipe line and compressor stations as soon as the Baltimore market is assured. Negotiations also are well under way for the financing and construction of the new central electric generating station for Union Gas and Electric Company at Cincinnati. With the erection of this station the company would be in position to care for an immense amount of new business in Cincinnati territory it is not now able to handle.

THE WESTERN STATES GAS AND ELECTRIC COMPANY has filed with the California Railroad Commission a supplemental application to its previous application for an order authorizing an issue of bonds of the face value $266,000 and notes of the face value of $33,000. The main application was filed on June 19, 1915, and was granted as asked. It is provided, among other things, that the company might sell bonds of the par value of $182,000 upon deposit with the trustee of the bond issue cash equal to the par value of the bonds, and that it might withdraw the cash from time to time as reports showing the expenditure of money for additions and betterments to the company's plant were approved by the commission. Already such expenditures, aggregating $111,288.80, have been approved. For November, $20,523 57 has been spent and an approval is asked for this amount.

THE Railroad Commission of California has issued an order authorizing the MODESTO GAS LIGHT, COAL AND COKE COMPANY, of Modesto, Stanislaus County, to execute a mortgage to the Union Trust Company of San Francisco, to secure a bond issue of $200,000 and to sell $65,000 par value of these bonds to net not less than 90%, the proceeds to pay off debts of $49,290.25, and to buy two lots for $800, and to extend mains and service in the Maze Addition for $8,998.95. The bonds must be sold before October 31, 1916. The company has a capital stock of $100,000, all outstanding, and its total indebtedness is less than $50,000. It made a profit last year of about $8,000.

CAREFUL estimates made in the closing days of the calendar year indicate the following record for BROOKLYN UNION GAS:

Gross in 1915 exceeded $11,000,000.
Net after taxes approximated $2,650,000.
Surplus after $1,500,000 amortization and all charges, approximated $2,000,000.
Surplus after dividends approximated $550,000.

The earnings in 1915 therefore represent approximately 19.3% on the $17,999,000 stock, which received dividends of 8%. They compare with 15.2% in 1914, 12.9% in 1913, 16.5% in 1912, 16.9% in 1911, and 17.4% in 1910. Of the 19.3% earnings, 8.3% was set aside for amortization, 8% paid in dividends, and 3%, or about $500,000, added to profit and loss surplus, making it approximately $6,500,000. The company publishes no annual report, and the Public Service Commission report is not due until about April 10. Gross of $11,000,000 in 1915 is a high record. It compares with $10,730,812 in 1914, $10,218,514 in 1913, $9 034,602 in 1912, and $9,467,930 in 1911. The improvement in net earnings is partly due to gain in output, but more largely through saving in expenses by reason of the cut in gas oil prices during 1915. Expenses thereby were decreased $635,000 compared with 1914. The same price for gas oil—3.0345 cents a gallon—continues throughout 1916.

THE AMERICAN LIGHT AND TRACTION COMPANY has declared a cash dividend of 1½% on the preferred stock, a cash dividend of 2½% on the common stock, and a dividend at the rate of two and one-half shares of common stock on every one hundred shares of common stock outstanding, all payable Feb. 1st, 1916. The transfer books will close at 2 o'clock noon on Jan. 15, 1916, and will reopen at 10 A.M., on Feb. 1st, 1916.

THE directors of the GENERAL GAS & ELECTRIC COMPANY have declared a regular quarterly dividend of 1¾% on the cumulative preferred stock, and have also declared an accumulated dividend of ½% on stock outstanding Sept. 30, 1914 and ¼% on stock outstanding Sept. 30, 1915. The company was organized in July, 1912. The stock was a cumulative 6% stock until July 1, 1915, when it became a cumulative 7% stock. The dividends just declared pay up all past accumulations and place the stock on a regular 7% basis.

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